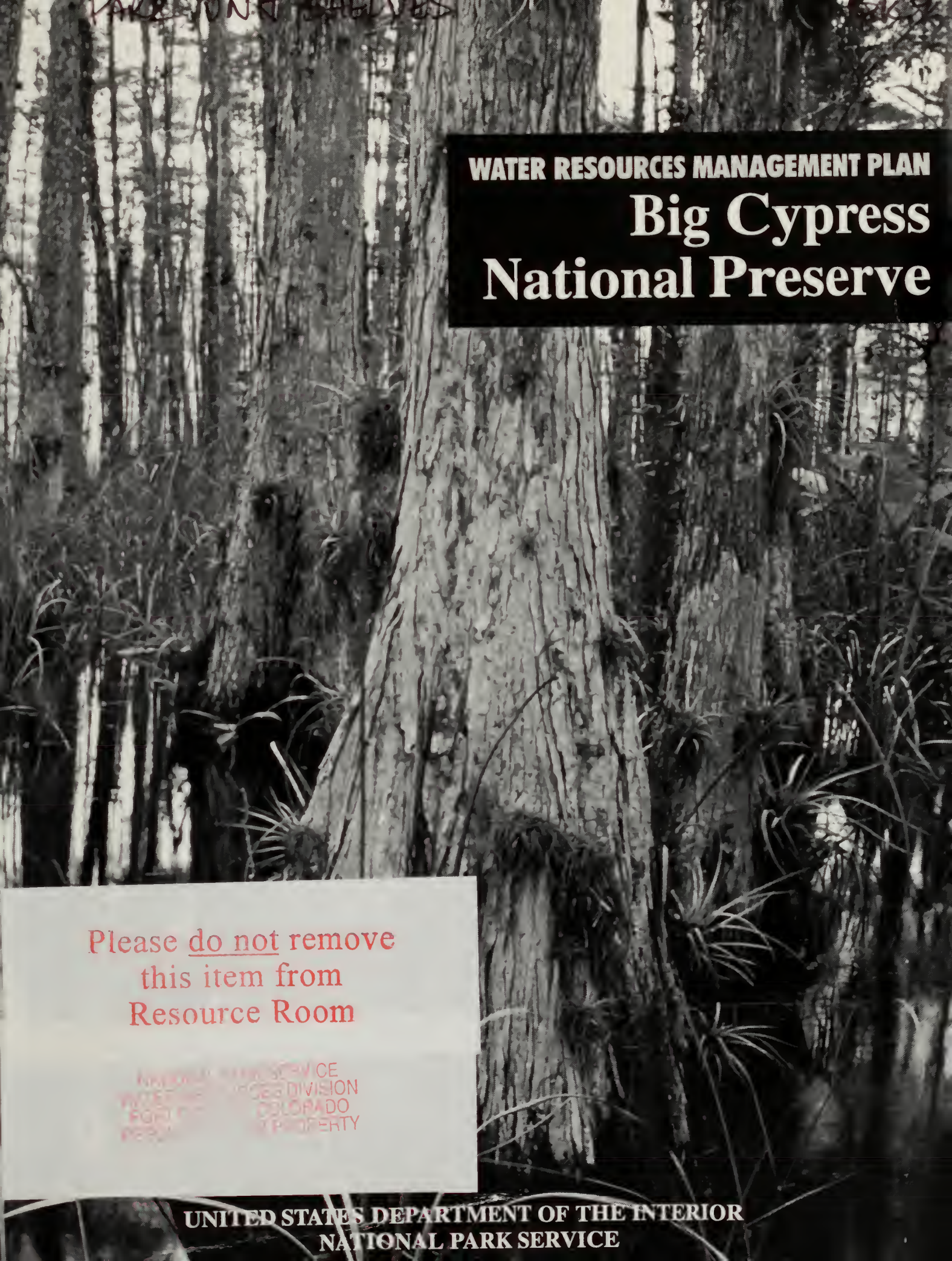

WATER RESOURCES MANAGEMENT PLAN

Big Cypress National Preserve

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WATER RESOURCES MANAGEMENT PLAN

BIG CYPRESS NATIONAL PRESERVE

May 1996

Prepared by

William J. Schneider
Water Resources Consultant
McLean, Virginia

Don P. Weeks
Hydrologist
National Park Service
Big Cypress National Preserve
Ochopee, Florida

David L. Sharrow
Hydrologist
National Park Service
Water Resource Division
Fort Collins, Colorado

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Approved by: Wallace A. Hibbard 4/15/96

Superintendent, Big Cypress National Preserve — Date

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PREFACE

Units of the National Park System are not required to develop a Water Resources Management Plan. However, where water resource issues or management constraints are particularly numerous, complex, or controversial, a Water Resources Management Plan is extremely useful in providing an identification and analysis of water-related information and issues, and presenting a coordinated action plan to address them. The Big Cypress National Preserve is a prime candidate for such a Water Resources Management Plan.

The Water Resources Management Plan is complementary to and consistent with the General Management Plan and the Minerals Management Plan for the Preserve. The Water Resources Management Plan is similar to the Preserve's Resources Management Plan, but includes a more thorough review of existing information, an in-depth analysis of water resources issues, and the development of an action plan to address them.

The total program represents an ambitious effort to establish a firm, hydrologically-sound basis for competent, rational management of the water resources of the Preserve through detailed understanding of its hydrology, knowledge of major influences on it, and a strong database to support decision-making.

Implementation of this program will require long-term, continuous commitments of personnel and funding. It is, however, essential in providing a level of data and hydrologic information needed by the Preserve for effective and wise management of its water resources, not only for its own benefit but also for the benefit of the total ecosystem of which it is a part.

The program is extensive. It will require time and commitment. It is also vital to the protection of the major resource of the Preserve -- its water.

INTRODUCTION

In 1974, an Act of Congress created the Big Cypress National Preserve in south Florida. At that time, the Big Cypress Swamp was a relatively pristine water-driven environment. Impetus for the establishment of the Preserve arose from a desire to protect a part of this environment from the severe modifications that had affected the greater Everglades ecosystem, its neighbor to the east. By 1974, the natural flow of water through Everglades National Park at the lower end of the Everglades drainage was severely altered in both quantity and timing by massive water-management activities to its north, and to some extent, by altered water quality. Although the basic hydrology of the Everglades was understood at this time, only limited studies of the Preserve's hydrology had been completed.

Over the next two decades, as more studies were completed both in the Big Cypress Swamp and Everglades, major linkages between the two became even more apparent. Because of the low, indistinct divide between the two, water in places flows from the Big Cypress Swamp into the Everglades, and in other places from the Everglades into the Big Cypress Swamp. As agriculture moved southward in Florida, it has become a threat to the water quality and characteristic sheet flow in the area. This, coupled with the impacts of the internal intrusions from both oil and gas operations and human activities permitted in the Preserve, documents the need and desirability of a comprehensive and cohesive plan for the management of the basic underlying resource of the Preserve - its water - for both the protection of its integrity within the Preserve and its importance in the management of the overall water resources of south Florida.

THE BIG CYPRESS SWAMP

About 17 million years ago, when sea level was considerably lower than today, south Florida emerged as a land mass. A warming trend followed, raising sea levels and shrinking the land area to roughly its present size. About 6,000 years ago, tropical plants began to flourish as they had during earlier inter-glacial periods. Rainfall increased, and during the period that followed, the Big Cypress Swamp and the Everglades came into existence.

Currently the Big Cypress Swamp is a large physiographic area extending westward from the Everglades to near the west coast, and southward from below the Caloosahatchee River drainage to the estuaries of the Gulf of Mexico (see Figure 1). Over the years, as urban growth and expanding

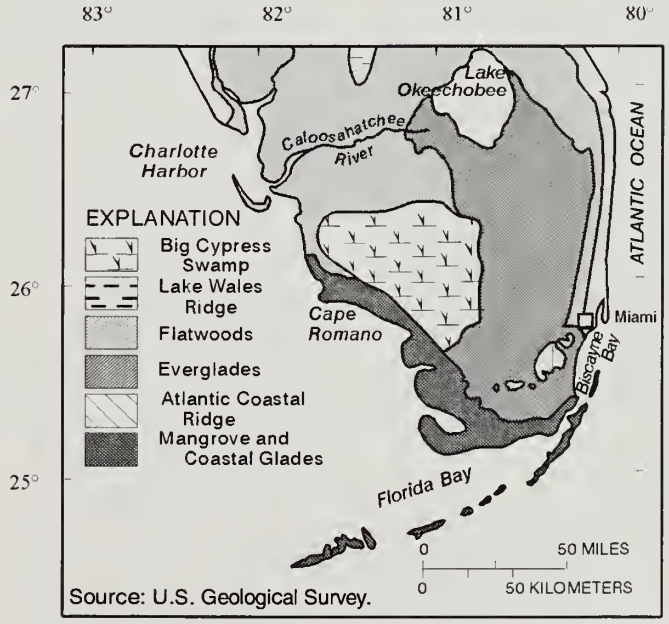


Figure 1. Location of Big Cypress Swamp and other physiographic regions of southern Florida.

agricultural development extended into the Everglades, with their inevitable impact on the water resources, an awareness arose of the need to preserve natural areas from future intrusions. This awareness focused on an essentially self-contained hydrologic watershed in the Big Cypress Swamp just west of the Everglades.

ESTABLISHMENT OF BIG CYPRESS NATIONAL PRESERVE

The importance of the Big Cypress Swamp watershed transcends its simple hydrologic values. The creation of the Big Cypress National Preserve in this watershed marked a turning point in natural systems management. Alarmed at the rapid destruction of the south Florida wetlands and catalyzed by the massive drainage accompanying the Golden Gate development in the west and the Dade Jetport in the east, the State of Florida adopted the Big Cypress Conservation Act of 1973. For the first time in south Florida, a large area was protected for its strategically-located ecosystems rather than simply as an isolated visually-attractive landscape.

The following year, part of the area came under Federal jurisdiction when Congress adopted Public Law 93-440 establishing the Big Cypress National Preserve which states that the purpose of the Preserve is "...to assure the preservation, conservation, and protection of the natural, scenic, hydrologic, flora and faunal, and recreational values of the Big Cypress Watershed...". Implicit in this enabling legislation is an acknowledgment of the water resources in every aspect of the Preserve's function. Water from this area drains slowly southwestward to the Gulf of Mexico through the estuarine environment of Everglades National Park. Although Everglades National Park is not specifically mentioned in the legislation, it is widely acknowledged that it was a concern for the Park that led to the establishment of the Preserve. This original section of the Preserve encompassed approximately 581,760 acres (see Figure 2)

ADDITIONS TO THE PRESERVE

In 1988, the original authorizing legislation was amended by Public Law 100-301, The Big Cypress National Preserve Addition Act, which authorized Federal acquisition of approximately 147,280 acres in two areas adjacent to the Preserve. The stated purposes of the Addition Act were two-fold: (1) to protect the lands above the northeastern boundary of the Preserve from the intrusive activities in the watershed that drain directly into the Everglades and thus into Everglades National Park, and (2) to obtain control over a narrow strip of land along its western boundary between the Preserve and the designated Fakahatchee Strand State Preserve.

The total area of the Preserve today, approximately 729,000 acres, is the largest remaining contiguous portion of the Big Cypress Swamp that still basically maintains its natural ecosystems (see Figure 2).

Today, the area faces numerous hydrologic threats to its environmental integrity. Some are external, ranging from the potential of upstream contamination to the redirection of ground water or surface water flow by agricultural and urban interests. Others are internal, ranging from major realignments of historic drainage patterns to potential oil spills from petroleum activities. At present, the integrity of the water resources of the Preserve cannot be maintained solely by the National Park Service.

After 22 years of existence, this water-based unit of the National Park System requires the development of this Water Resources Management Plan to provide direction in making appropriate management decisions. The plan will also enable the National Park Service to implement measures to protect and manage those exceptional resources identified in the enabling legislation. These natural resources include vegetation, fish and wildlife. Cultural activities include recreation and uses of the land associated with legislative rights of the American Indians.

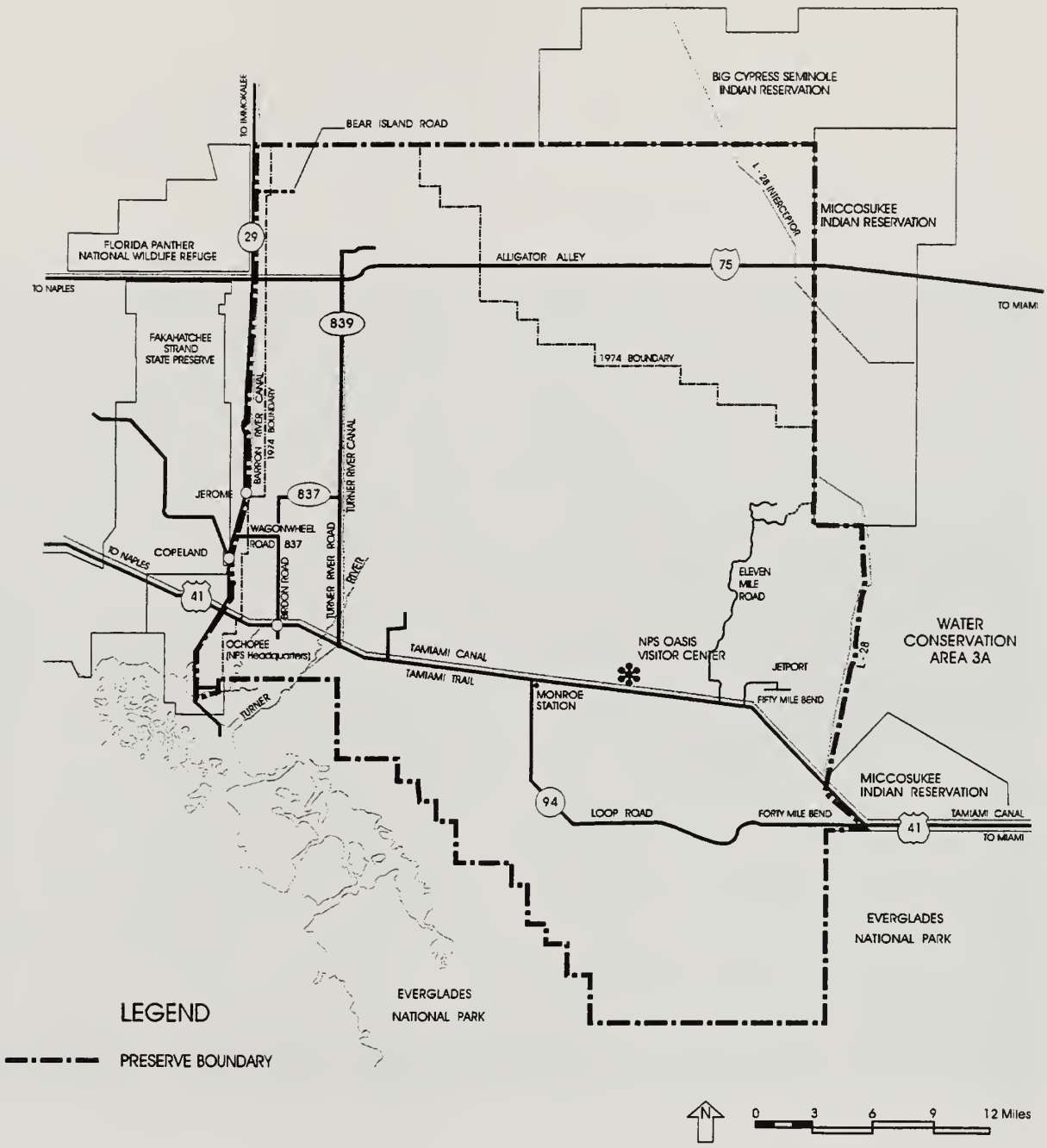


FIGURE 2. BIG CYPRESS NATIONAL PRESERVE

BIG CYPRESS NATIONAL PRESERVE
United States Department of the Interior, National Park Service

THE HYDROLOGIC ENVIRONMENT

The Preserve is part of a unique water-dependent ecosystem resulting from a combination of its climate and physiographic setting: the climate provides the hydrologic input; the physiographic setting controls the distribution of the input.

Unlike the Everglades, where human intrusions from agriculture and drainage have required massive water management and control efforts, much of the Big Cypress Swamp is still a relatively pristine wetland system with only minor intrusions. While the Everglades became the focus of numerous efforts to understand that system, relatively little effort has been extended toward a similar understanding of its neighbor to the west.

In 1969, at the request of the Secretary of the Interior, the U.S. Geological Survey undertook an evaluation of the hydrologic characteristics of the Big Cypress Swamp based upon the limited available data and augmented by additional flow and water quality data specifically collected for the study from November, 1969 through May, 1970. The report by Klein, et al. (1970) provides a baseline evaluation of the Big Cypress Swamp prior to the establishment of the Preserve. Two subsequent reports (Schneider and Flora, 1986, and Schneider, 1990) draw heavily on these earlier reports for the descriptions of the original Preserve and its Additions. The following description of the baseline hydrology of the Preserve is taken from these and subsequent available documents.

PHYSIOGRAPHIC SETTING

The 720,000-acre Preserve occupies almost half of the Big Cypress Swamp physiographic province. Surface elevations in the Preserve range from near mean sea level (msl) in the south to 19 feet msl in the northeast corner. Although land slopes average less than one-half foot per mile, local variations in elevations from sloughs to hammocks may be as much as 1 to 2 feet.

Three general drainage patterns predominate in the Preserve (see Figure 3). These three drainages are:

1. A broad band occupying most of the original Preserve, of southwest trending sloughs and strands separated by marl prairies and pinelands in its eastern portion at elevations of about 9 feet msl to an interior highland of domes, hammocks, and pines rising to 14 feet msl.

2. In the Additions to the north, a broad, interior lowland channel with an aggregation of sloughs and hammock islands that drain directly into the Everglades.

3. In the northwestern corner of the Preserve, a small area of marshes, ponds, prairies, hammocks, and sloughs that drain into the Fakahatchee Strand west of the Preserve.

PRECIPITATION

Nearly 80 percent of the rain normally falls during the six-month wet season of May through October. Normal monthly rainfall for the Everglades and southwest Florida are shown in Figure 4. Based on composited data from 12 Weather Bureau stations on the periphery of the Preserve, Klein, et al. (1970) estimated that rainfall averages 53 inches per year, but has ranged from 35 to 80 inches. However, the nature of the precipitation in south Florida--large volumes from convective storms over parts of the area--lends a large degree of uncertainty to any estimates.

Drought is an occasional problem in the Preserve, especially with its resultant threat of wildfires. An extreme drought in 1971, one of the worst on record with less than 40 inches of rain recorded in the Everglades, led to severe wildfire damage in the Preserve. The most recent drought for south Florida was in 1988-1989, when the majority of precipitation monitoring stations in Everglades National Park recorded less than 40 inches of rain.

The long-term precipitation monitoring stations in the Preserve are located at the Preserve's Visitor Center at Oasis and the Headquarters at Ochopee (see Figure 3). The mean monthly rainfall for each station is shown in Figure 5. These data indicate that approximately 75 percent of the rainfall occurred during the six month wet season, which reflects the precipitation patterns reported by Klein for south Florida. As shown in Figure 3, the Preserve has five other precipitation monitoring stations located at the Gum Slough, North Bear Island, and Monument water quality monitoring stations and at Miles City, and Raccoon Point's Oil Pad #2. These stations are relatively new with minimal baseline precipitation data.

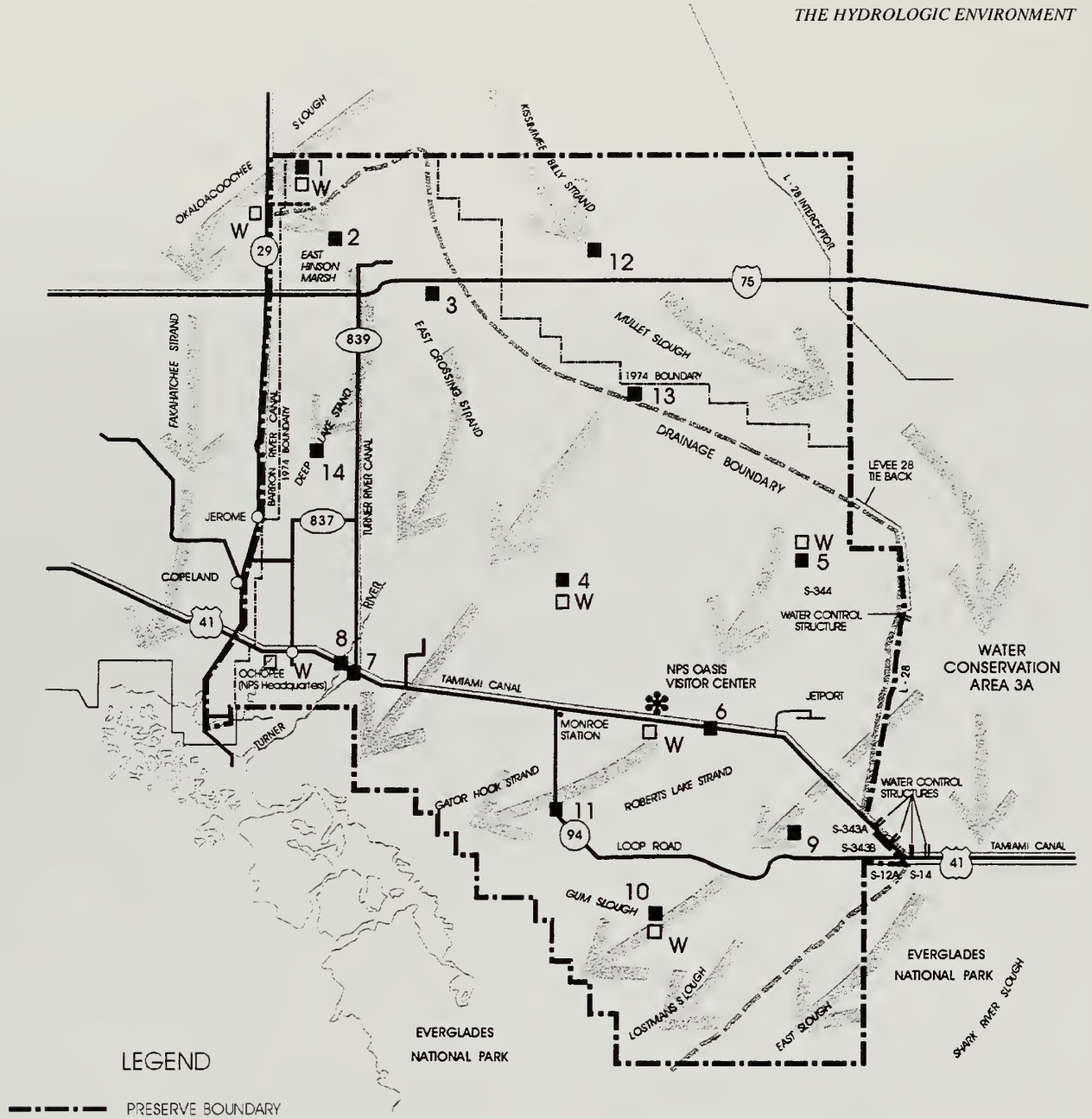


FIGURE 3. HYDROLOGIC FEATURES

BIG CYPRESS NATIONAL PRESERVE
United States Department of the Interior National Park Service

A significant part of the total rainfall is associated with hurricanes and tropical storms moving across the area. During the months of June through September, typically the wettest months of the year, a significant part of the total can result from one storm event. Hurricanes, though not frequent, can be both severe and damaging. Dunn, et al. (1967) cites 16 hurricanes that affected the Preserve between 1885 and 1965. In 1992, Hurricane Andrew, which destroyed entire communities to the east, caused only minimal impacts to the Preserve's ecosystem.

GROUND WATER AQUIFERS

Knowledge of the geologic character of the Preserve is limited to several early studies in Collier County and southwestern Florida. Because the surficial aquifers in the Preserve are directly interrelated to surface flows and influence the hydrology of the Preserve, the following discussion emphasizes their role in the hydrologic environment.

The Preserve is underlain largely by an extensive surficial aquifer (Shallow Aquifer) extending from the vicinity of Forty Mile Bend to the west coast and covering almost all of Collier County and the northern part of Monroe County (see Figure 6). At its eastern edge, it abuts the western part of the Biscayne Aquifer. The Shallow Aquifer is the prime source of fresh water supplies in Collier County. The aquifer, which is approximately 130 feet thick in western Collier County, becomes progressively thinner to the east, where it eventually disappears near the eastern boundary of the Preserve. Throughout much of the Preserve, the limestone of this shallow aquifer is within 10 feet of the surface. Although the aquifer is non-artesian, it contains beds and lenses of sandy clay and fine sands of low permeability which tend to retard the circulation of water in the aquifer. Generally, the limestone parts of the aquifer are the important water-yielding sections because they are riddled with solution holes and thus highly permeable. However, the upper part of the limestone section is typically hard and dense and of lower permeability than below. This low permeability restricts the ability of shallow canals to drain water from storage in the aquifer. The aquifer is recharged by rainfall during the wet season, and overland flow occurs when the aquifer is saturated.

Underlying this shallow aquifer is a thick zone of low yielding clays, marls and fine sands that form a confining bed over the Floridan Aquifer, which generally lies at depths over 400 feet. The Floridan Aquifer is artesian and yields mineralized water of as much as 500 milligrams per liter (mg/l) of dissolved solids to flowing wells.

FLOW CHARACTERISTICS

During the rainy season, shallow depressions fill with water, and, because of the poor drainage, the water remains on the land surface until it evaporates or slowly drains off through sloughs or strands. As much as 90 percent of the Preserve is inundated to depths ranging from a few inches to more than three feet at the height of the rainy season. As the dry season begins, typically in October, water levels start to recede. The recession continues until May, when perhaps 10 percent of the Preserve is covered by water in ponds and sloughs. Although the surface of the Preserve seems flat with no well-defined stream systems, flows generally follow bedrock undulations. Marshy sloughs occupy the shallower undulations, with cypress strands in the deeper ones. These relatively low channels tend to control surface flows, since the water table is below the crests of the undulations most of the time. However, even during high water when there is sheet flow over extensive areas, the bedrock flows still carry a relatively large volume of the water.

Long-term records of flow are available at three U.S. Geological Survey monitoring sites in the Preserve. These monitoring sites are at Bridge 105 and Bridge 84 on the Tamiami Canal, located 12 miles west of Forty Mile Bend and 5 miles east of State Route 29, respectively, and on the Barron River Canal approximately 3 miles north of U.S. Highway 41. The following discussion is based upon records of the Tamiami Canal at Bridge 105 from 1969-1970 and 1989-1990. Typical water level fluctuations at this site are shown in Figure 7 and are considered indicative of the water conditions within the Preserve. The hydrographs reflect the natural cyclical rise of water levels during the rainy season and their decline during the dry season, with inundation ranging from 185 days in 1989 to 351 days in 1969. The rate at which water levels recede after the rainy season is a general measure of the runoff characteristics of the Preserve. The recession rates in the channel at Bridge 105 in March, April and May, 1970, ranged from 0.01 to 0.06 feet per day during relatively high water stages (8.5 - 7.5 ft. msl) when the area was inundated, and from 0.07 to 0.11 feet per day when water levels were lower (7.5 - 6.5 ft. msl) and generally below land surface. These rates confirm the general observations that runoff is slow, and that water is stored for extended periods.

The stage-duration curves for Bridge 105 during two periods, 1952-1969 and 1969-1994, are shown in Figure 8. These curves indicate the percentage of time a selected stage is equaled or exceeded at the site. The

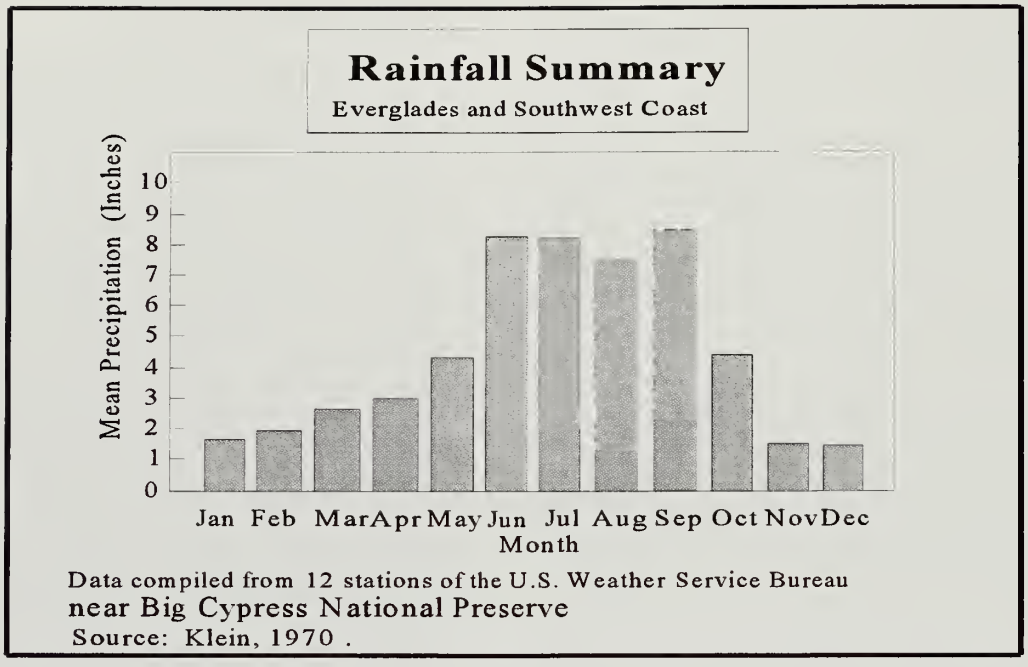


Figure 4. Rainfall Summary, Everglades and Southwest Coast.

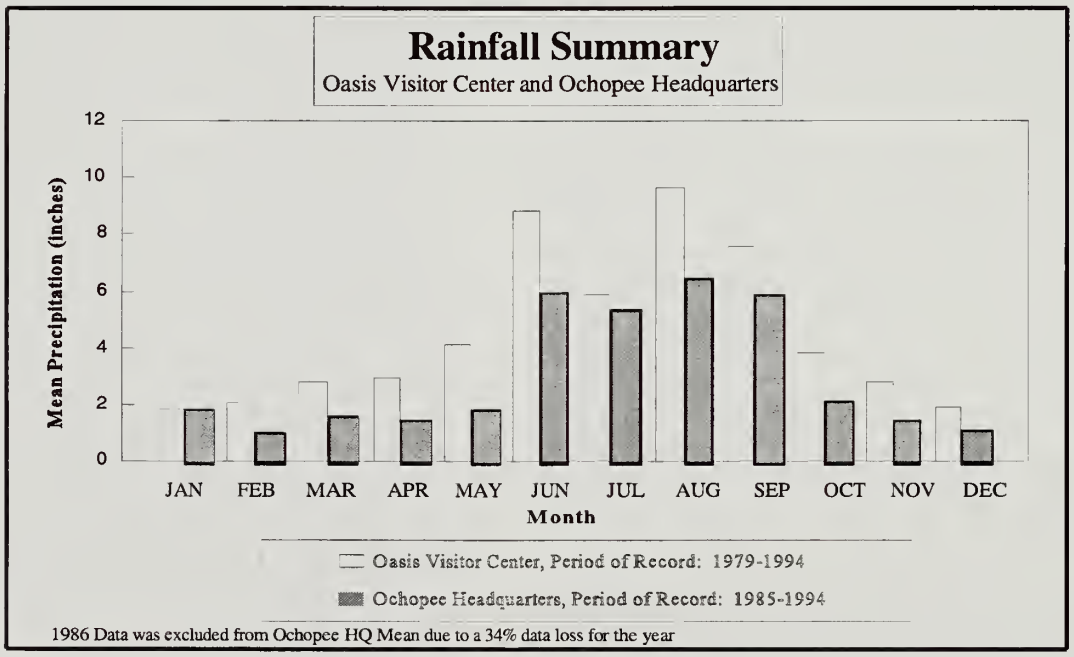


Figure 5. Monthly Precipitation, Oasis and Ochopee Stations.

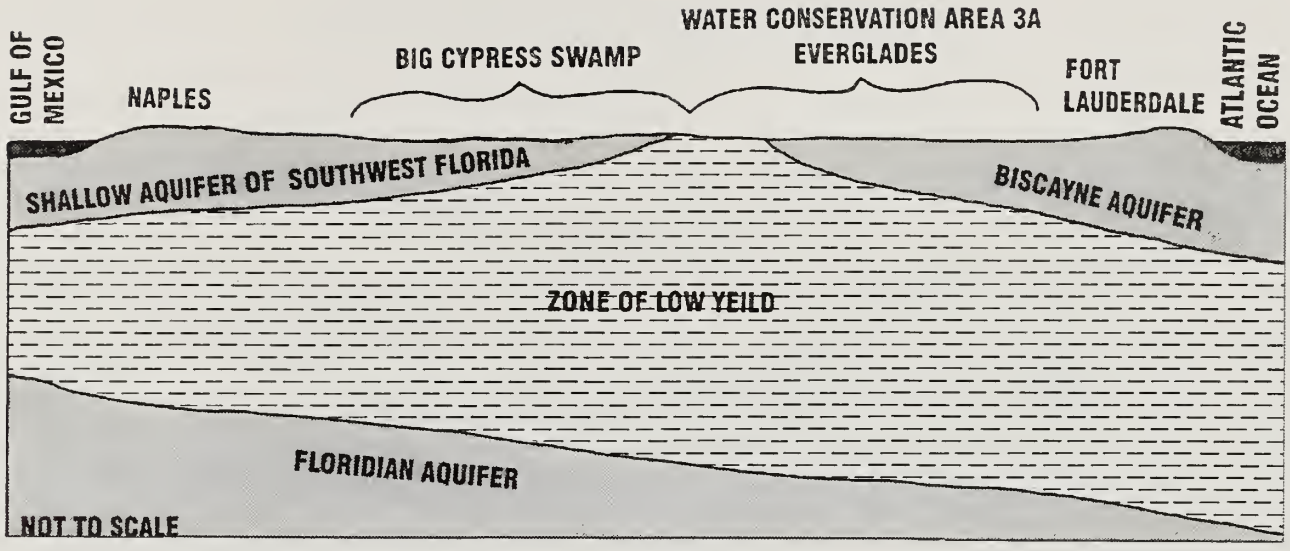


Figure 6. Profile of Aquifer Systems in the Vicinity of Big Cypress National Preserve (adapted from Klein et al., 1975).

total range of water levels for the two periods were approximately 6 feet. These ranges in water stage represent the extremes between flood and drought for the respective periods. From November 1969 to February 1970, water levels ranged from 8.0 to 8.9 feet msl, indicating a wetter than average condition with widespread inundation. At a level of about 7.5 feet msl, the area of inundation is greatly diminished and the stage-duration curve represents ponded water in the area. At about 7.0 feet msl, there is a decrease in inundation, producing isolated ponds and major sloughs. Water levels below 7.0 feet msl represent a continued reduction in inundation (i.e., drying of ponded water).

The stage-duration curve for the 1969-1994 period indicates that the extreme high and low water stages were lower than in the earlier period of record (1952-1969). Although this represents an overall lowering of water stages during this latter period, it is not known if this reflects the management of water releases from Conservation Area 3A into the Tamiami Canal and to Everglades National Park.

The flows from 1964 through 1994 across the Tamiami Trail through the 29 bridges between Forty Mile Bend and Monroe Station are shown in Figures 9, 10 and 11. Flows during this period ranged from zero during droughts to more than 3,000 cubic feet per second (cfs) after Tropical Storm Gordon in 1994 (see Figure 9).

The wide variation in annual mean discharge through the Tamiami Canal between Forty Mile Bend and Monroe Station is shown in Figure 10. Annual mean discharges ranged from 106 cfs in 1972 to 937 cfs in 1994. As expected, variations in monthly mean discharge also occurred. As shown in Figure 11, the mean monthly discharge defines the wet season of May through October, when water levels in the Preserve typically rise with increased precipitation. The months with the greatest variation in discharge from 1964 through 1994 were June, July, August and September, when the hydrology is more dynamic as a result of increased precipitation and storm events. During these months, discharge between Forty Mile Bend and Monroe Station varied from 0 cfs to 2021 cfs.

The regulation of flow on the Barron River Canal is intermittent and undocumented at eight control weirs. As a result, records of flow do not show normal patterns of variability, and records prior to 1960 show a number of anomalous flows of unknown causes. The Barron River Canal parallels State Route 29 and connects the Big Cypress and Okaloacoochee Slough drainages in the northeast corner of the Preserve. The U. S. Geological Survey data from 1953 through 1980 indicate the variability of the flow. During this period, flow in the Barron River Canal averaged 71,510 acre-feet annually to the coastal environment in its vicinity, with annual flows ranging from a maximum of 134,800 acre-feet to a minimum of 41,890 acre-feet.

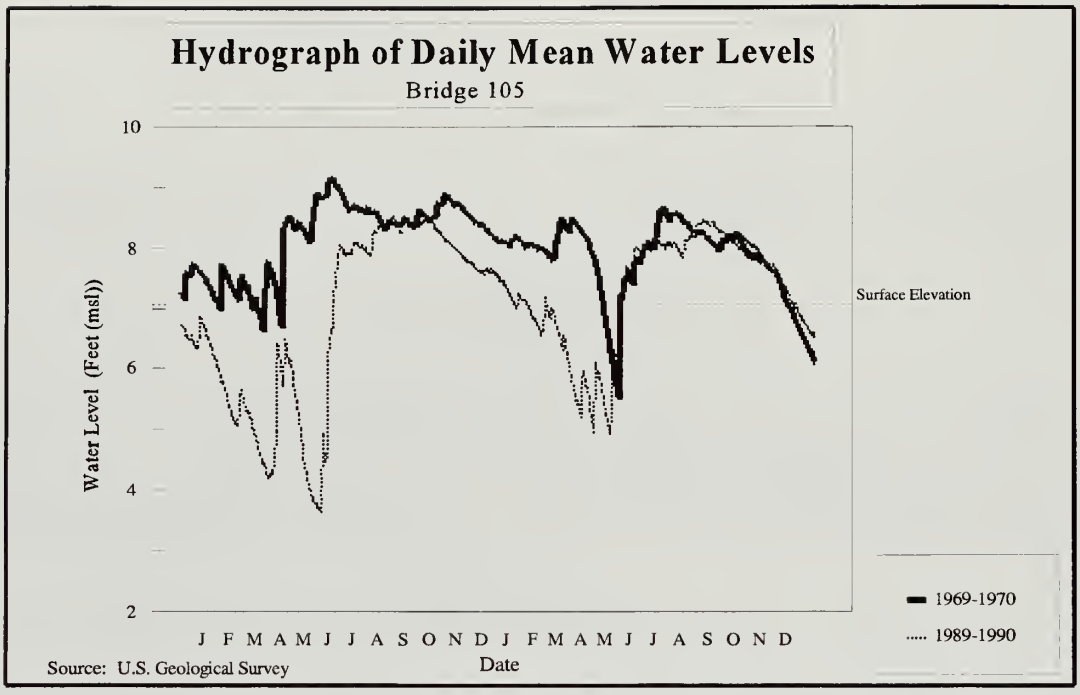


Figure 7. Hydrograph of Daily Mean Water Levels for Bridge 105, 1969-1970 and 1989-1990.

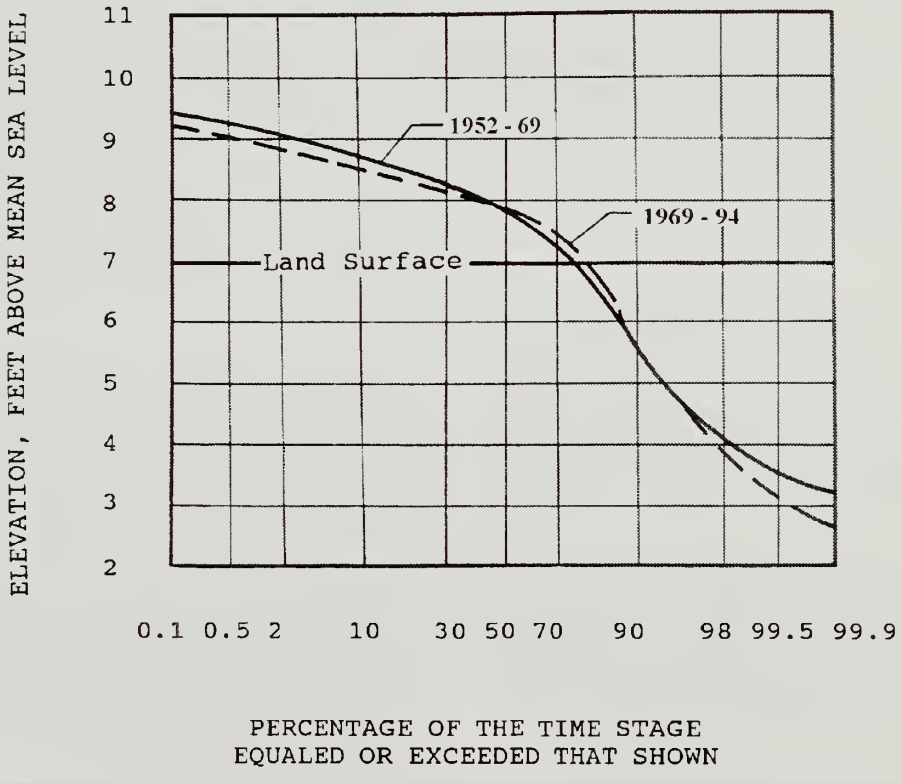


Figure 8. Stage Duration Curves for Bridge 105.

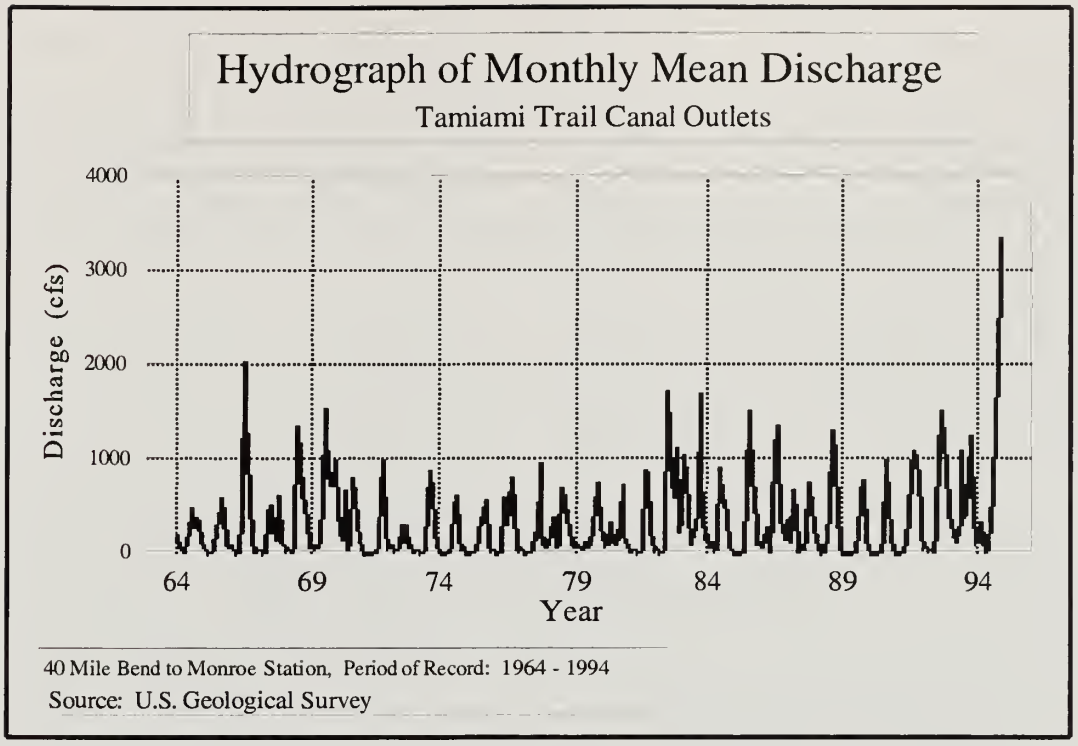


Figure 9. Hydrograph of Monthly Mean Discharge for Tamiami Trail Canal Outlets, 1964-1994.

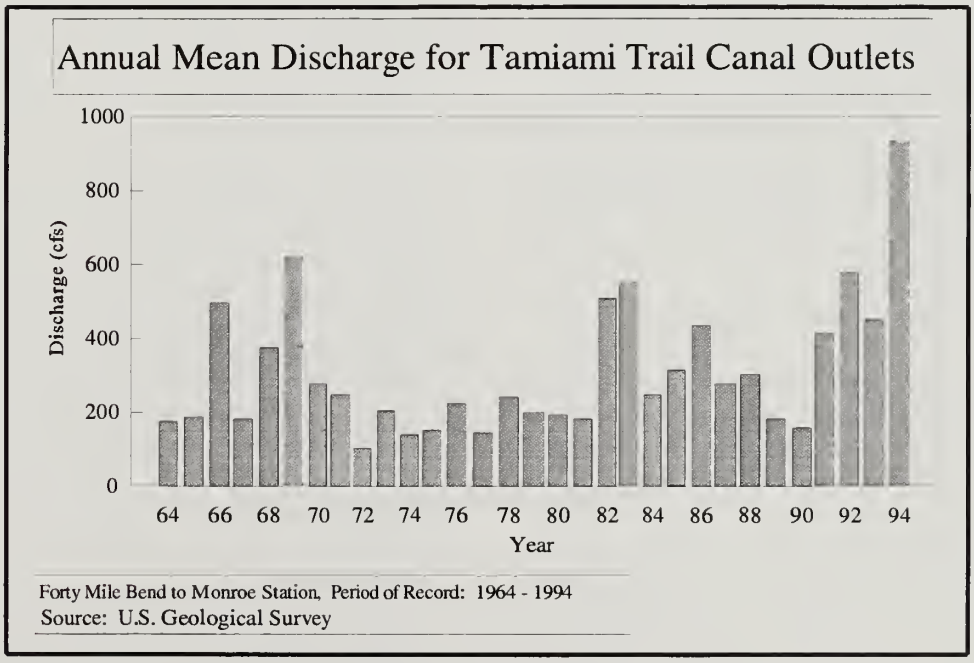


Figure 10. Annual Mean Discharge for Tamiami Trail Canal Outlets, 1964-1994.

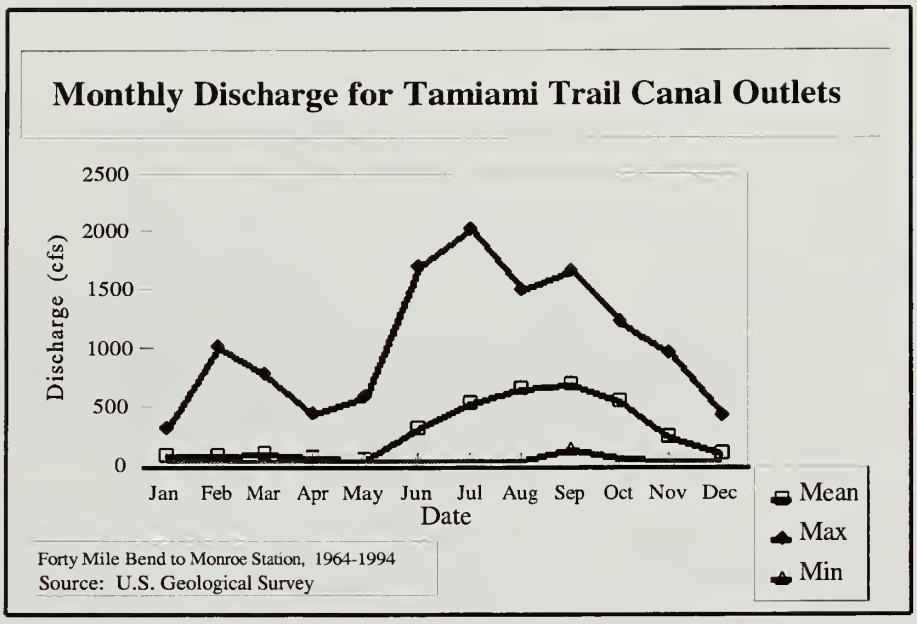


Figure 11. Monthly Discharge for Tamiami Trail Canal Outlets, 1964-1994.

The Florida Department of Transportation, in cooperation with the South Florida Water Management District, is currently involved in a project that includes the installation of two water control structures in the Barron River Canal between Interstate 75 and U.S. Highway 41. The preliminary design includes the installation of concrete culverts beneath State Route 29, approximately 100 feet upstream (north) of each control structure. The purpose of this project is to provide a more regulated flow in the Barron River Canal and to allow some water to flow from the canal to the west side of State Route 29 and into Fakahatchee Strand.

WATER AND SEDIMENT QUALITY

As previously discussed, the construction of the Dade-Collier Transition and Training Airport (referred to as the Jetport) was one of the major catalysts for creating the Preserve and, as a result, much of the early water quality information was collected in its vicinity, particularly the numerous studies by McPherson (1969, 1970, 1971, 1972). The many other studies from this period were more widely scattered (e.g., Black, Crow, and Eidsness Inc., 1975; Carter, et al., 1973; U.S. Environmental Protection Agency, 1971; Freiberger and McPherson, 1973; Kolipinski and Higer, 1969; Klein, et al., 1970; Little et al., 1970; Miller, 1975; Odum, 1953; Shampine, 1975; Slack and Kaufman, 1973; Wimberly, 1973, 1974). Like studies by McPherson, these data sets generally concentrated in areas near roads and canals, and thus reflect some minor human influences to water quality. With the exception of the water reports prepared by Everglades National Park, most of these are discussed in Duever, et al., (1986).

Analyses of water collected from 15 sites in the Preserve from November 1969 and March 1970, indicated the water to be of high quality. Concentrations of nitrogen, phosphorus, total organic carbon (TOC), and persistent pesticides, which often serve as indicators of pollution, generally were similar to concentrations in nearby, relatively uninhabited areas and considerably less than those of nearby urban areas. Concentrations of total nitrogen ranged from 0.19 mg/l to 1.85 mg/l and averaged 0.82 mg/l. Approximately 80 percent was organic, indicative of a natural environment. Total phosphorus (as P) concentrations ranged from below the detection limit to 0.11 mg/l and averaged 0.02 mg/l. Concentrations of TOC ranged from 4 mg/l to 27 mg/l. For comparison, TOC concentrations as high as 420 mg/l, which is probably indicative of pollution, have been measured in Dade County canals along the east coast of Florida. Although components of the DDT family (DDT, DDD, DDE) were the most commonly detected

pesticides, their concentration in sediments were considerably lower than those of sediments in Broward County canals. An average concentration in the Preserve was 5.09 micrograms per kilogram (µg/kg), and 62.91 µg/kg in Broward County.

During the period from 1966 to 1980, the U.S. Geological Survey collected 119 water samples at the Barron River Canal gaging station for analyses. Turbidity ranged from 0.3 nephelometric turbidity units (NTU) to 6.1 NTU; dissolved oxygen ranged from 1.8 mg/l to 10 mg/l, averaging 4.5 mg/l; pH ranged from 6.9 to 9.0, averaging 7.5; and specific conductance ranged from 195 to 725 µmhos. Forty of the samples were analyzed for iron, which ranged from 0.05 mg/l to 0.79 mg/l. Minor cadmium concentrations ranging from 1.0 micrograms/liter (µg/l) to 2.0 µg/l were recorded in three samples and mercury concentrations less than 2.0 µg/l were recorded from three samples. Two samples were analyzed for zinc with concentrations ranging from "trace" to 64 µg/l. Extremely high chloride and sulfate concentrations were measured on occasion during the dry season as a result of salt water intrusion into the canals. Total nitrates and nitrites ranged from 0.004 mg/l to 0.25 mg/l; total nitrogen ranged from 0.10 mg/l to 2.47 mg/l, averaging 0.98 mg/l; and total phosphorous ranged from 0.006 mg/l to 0.14 mg/l, averaging 0.03 mg/l.

A more extensive and continuous water quality monitoring program began in 1988 in the Preserve (Weeks, 1989). In 1988, water quality parameters were measured monthly at eleven stations in the Preserve. Samples for all monitoring stations were analyzed in the field for water temperature, pH, dissolved oxygen, conductivity, and alkalinity. Selected samples were also monitored for specific nutrients and metals. During 1988, the general water quality of the Preserve was good, based on the data collected. However, anomalous lead and mercury concentrations of 0.04 mg/l and 0.6 µg/l, respectively, were recorded. These two concentrations exceeded the Class III water quality standards established by the Florida Department of Environmental Regulation (currently the Florida Department of Environmental Protection). Although the water quality monitoring program in the Preserve has continued since 1988, personnel shortages have precluded annual assessments of the data.

A recent report prepared by Collier County Environmental Services Division in 1994 summarized the sediment quality throughout Collier County from 1989 to 1991. Two of the sediment sampling sites were located on the Barron River Canal adjacent to State Route 29 and one site was located on the Turner River at U.S. Highway 41. A d-BHC (benzene hexachloride pesticide) concentration of 99 µg/kg (microgram per kilogram), recorded at the north Barron River Canal station, was the highest reported by Shahane (1994) for the State of Florida. A relatively high concentration (1.3 µg/kg) of aldrin, a pesticide no longer produced in the United States, was also detected in the Barron River Canal. Higher aldrin concentrations, up to 7.49 µg/kg, have been reported in Everglades National Park. The highest concentrations of lead during the study were detected at the Turner River station, where concentrations exceeded 100 mg/kg.

WATER RESOURCES MANAGEMENT PLANNING CONSIDERATIONS

Overall management concerns for the Preserve are set forth in the General Management Plan for the Big Cypress National Preserve, approved in 1992. This plan reconfirms the premise of the original enabling legislation that water is a controlling force on the ecosystems of the Preserve.

At the time of its designation as a National Preserve in the National Park System, the area was--and still is--predominately an undeveloped wetland with few roads, limited occupancy, and sparse use. This limited occupancy and land disturbance, both past and present, presents both problems and opportunities for responsible management of the water resources.

NEED FOR A WATER MANAGEMENT PLAN

The very establishment of the Preserve demonstrates that awareness of the importance of its water resource has long existed. However, during the early years of the Preserve, very limited staffing precluded extensive hydrologic activities, and limited activities were conducted by the staff of the National Park Service South Florida Research Center or by contract. Mitigation activities such as restoration of original ground elevations through removal of house pads, and filling of borrow canals and borrow pits were done more for aesthetic and practical considerations rather than for hydrologic benefits although some direct mitigation to impacts on the water resources resulted from these activities. Some proposals for funding have been included in the General Management Plan and Resources Management Plan prepared by the staff of the Preserve.

Today the Preserve faces a myriad of hydrologic threats to its environmental integrity. The recent efforts of the Interagency Task Force on South Florida Ecosystem Restoration have focused sharp attention within the Preserve on its significant role in overall water management in south Florida. After 20 years of existence, this water-based National Park unit requires the development of a formal Water Resources Management Plan to provide direction to the staff in making responsible decisions in managing the complexity of ever-increasing water problems both in the Preserve and in south Florida.

National Park Service policies require that each unit of the National Park System develop and implement a General Management Plan to provide the overall basis for managing the unit's resources, uses, and facilities. The General Management Plan for the Preserve was prepared to serve as a guide for management over the next 10 to 15 years. In addition to the General Management Plan, each unit may develop appropriate "action" plans to address specific resource needs and actions. This Water Resources Management Plan is such a plan. It is designed to serve as a management action plan to guide the water-related activities of the Preserve over the next 10 to 15 years. This plan is complementary to and consistent with the General Management Plan and the Minerals Management Plan. It also addresses the water resources component of the Resources Management Plan in greater detail.

LEGISLATIVE AND PLANNING CONSTRAINTS AND REQUIREMENTS

Numerous Federal and state statutes, regulations, and executive orders mandate specific regulatory considerations on the management of water resources in the Preserve.

FEDERAL LEGISLATION AND EXECUTIVE ORDERS

National Park Service Organic Act

In 1916 Congress created the National Park Service to:

> "promote and regulate the use of the Federal areas known as national parks, monuments, and reservations ... by such means and measures as to conform to the fundamental purpose of said parks, monuments, and reservations, which purpose is to conserve the scenery and the natural and historic objects and the wildlife therein and to provide for the enjoyment of the same in such a manner and by such means as will leave them unimpaired for the enjoyment of future generations." (National Park Service Organic Act, 16 USC 1).

Recognizing the growing diversity among the various units of the National Park System, Congress passed legislation in 1970 declaring:

> "...that these areas, though distinct in character, are united through their inter-related purposes and resources into one national park system as cumulative expressions of a single national heritage; that, individually and collectively, these areas derive increased national dignity and recognition of their superb environmental national quality through their

inclusion jointly with each other in one national park system preserved and managed for the benefit and inspiration of all the people of the United States..." (16 USC 1a-1).

All areas of the National Park System are to be promoted and regulated in a manner "...consistent with and founded in..." the National Park Service Organic Act of 1916 and other laws generally applicable to the National Park Service, and so as not to be "...in derogation of the values and purposes for which these various areas have been established, except as may have been or shall be directly and specifically provided by Congress." (16 USC 1a-1).

Public Law 93-440, Establishment of Big Cypress National Preserve

Public Law 93-440 established the Big Cypress National Preserve in 1974 for the purpose of ensuring, "...the preservation, conservation and protection of the natural, scenic, hydrologic, floral and faunal, and recreational values of the Big Cypress Watershed in the State of Florida and to provide for the enhancement of public enjoyment thereof...". Although Everglades National Park was not specifically mentioned, a review of House and Senate Reports (Senate Report 93-1128 and House Report 93-502) identifies the water flow from the Preserve as essential to the survival of its neighbor and the south Florida ecosystem.

The following activities are to be regulated in the Preserve by the National Park Service in accordance with Public Law 93-440:

- Motorized vehicles (off-road vehicle use)
- Exploration and extraction of oil, gas and other minerals
- Grazing
- Draining or construction of works which alter natural water courses
- Agriculture
- Hunting, fishing, and trapping
- New construction
- Traditional land use by the Miccosukee & Seminole Tribes

Public Law 100-301, Big Cypress National Preserve Addition Act

Public Law 100-301 expanded the Big Cypress National Preserve's boundary in 1988 to include 147,280 acres (the Additions) of adjacent lands. The primary purposes of this Addition Act, as defined in Section 2 of Public Law 100-301 were:

- To limit development pressure on lands bordering the Preserve.

- To enhance the protection of Everglades National Park while providing recreational opportunities and other public uses, as appropriate.

The Addition Act reinforces the intent of Public Law 93-440, in that the Preserve was established to protect a fragile water-dominated environment which is a significant component of the Everglades ecosystem.

Federal Water Pollution Control Act (Clean Water Act)

The Federal Water Pollution Control Act, more commonly known as the Clean Water Act, was first promulgated in 1972 and amended in 1977, 1987, and 1990. This law was designed to restore and maintain the integrity of the nation's waters. Goals set by the Act were swimmable and fishable waters by 1983 and no further discharge of pollutants into the nation's waterways by 1985. The two strategies for achieving these goals were a major grant program to assist in the construction of municipal sewage treatment facilities and a program of "effluent limitations" designed to limit the amount of pollutants that could be discharged.

As part of the Act, Congress recognized the primary role of the states in managing and regulating the nation's water quality within the general framework developed by Congress. All Federal agencies must comply with the requirements of state law for water quality management, regardless of other jurisdictional status or land ownership. States implement the protection of water quality under the authority granted by the Clean Water Act through best management practices and through water quality standards. Best management practices are defined by the U.S. Environmental Protection Agency as methods, measures or practices selected by an agency to meet its non-point control needs. These practices include but are not limited to structural and non-structural controls and operations and maintenance procedures. They can be applied before, during, and after pollution-producing activities to reduce or eliminate the introduction of pollutants into receiving waters. Water quality standards are composed of the designated use or uses made of a water body or segment, water quality criteria necessary to protect those uses, and an anti-degradation provision which may protect the existing water quality.

Section 404 of the Clean Water Act requires that a permit be issued for discharge of dredged or fill materials in waters

of the United States including wetlands. The U.S. Army Corps of Engineers administers the Section 404 permit program with oversight veto powers held by the U.S. Environmental Protection Agency. The Environmental Protection Agency, the U.S. Fish and Wildlife Service and the National Marine Fisheries Service provide advice on the environmental impacts of proposed projects.

Section 402 of the Act requires that a National Pollutant Discharge Elimination System (NPDES) permit be obtained for the discharge of pollutants from any point source into the waters of the United States. Point source, waters of the United States, and pollutants are all broadly defined under the Act, but generally all discharges and storm water runoff from major industrial and transportation activities, municipalities, and certain construction activities must be permitted by the NPDES program. The Environmental Protection Agency usually delegates NPDES permitting authority to the state. The state, through the permitting process, establishes the effluent limitations and monitoring requirements for the types and quantities of pollutants that may be discharged into its waters. Under the antidegradation policy, the state must also insure that the approval of any NPDES permit will not eliminate or otherwise impair any designated uses of the receiving waters.

Off-Road Vehicle Use (Executive Orders 11644 and 11989)

These executive orders require Federal land managers to control off-road vehicle (ORV) use on public lands. Executive Order 11644 requires the designation of trails and areas which are based on the protection of the resources of the lands. Executive Order 11989 requires Federal agencies to close areas to ORV use if it is causing or will cause adverse affects on soil, vegetation, wildlife, wildlife habitat, cultural or historic resources.

Floodplain Management (Executive Order 11988)

This executive order requires all Federal agencies to "reduce the risk of flood loss, ... minimize the impacts of floods on human safety, health and welfare, and... restore and preserve the natural and beneficial values weaved by floodplain" (Goldfarb, 1988). Federal agencies are therefore required to implement floodplain planning and consider all feasible alternatives which minimize impacts prior to construction of facilities or structures. Construction of such facilities must be consistent with Federal flood insurance and floodplain management programs. To the extent possible, National Park System facilities should be located outside these areas. National Park Service guidance pertaining to Executive Order 11988 is found in Floodplain Management Guidelines (National Park Service, 1993).

Protection of Wetlands (Executive Order 11990)

This executive order requires all Federal agencies to "...minimize the destruction, loss or degradation of wetlands, and preserve and enhance the natural and beneficial values of wetlands..." (Goldfarb, 1988). Unless no practical alternatives exist, Federal agencies must avoid activities in wetlands that have the potential for adversely affecting the integrity of the ecosystem. National Park Service guidance for compliance with Executive Order 11990 is found in Floodplain Management and Wetland Protection Guidelines, published in the Federal Register 45 FR 35916, Section 9.

National Environmental Policy Act

Congress passed the National Environmental Policy Act (NEPA) in 1969. NEPA established a general Federal policy for the responsibility of each generation as trustee of the environment for the succeeding generations. Specifically, NEPA requires that an environmental impact statement (EIS) be prepared as part of the review and approval process by Federal government agencies of major actions which significantly affect the quality of human life. The primary purpose of an EIS is to ensure evaluation of the impacts of proposed projects and facilitate public review. An environmental assessment (EA) may be prepared prior to initiating an EIS in order to determine if the preparation of an EIS is required.

Regulations implementing NEPA require the cooperation of Federal agencies in the NEPA process. The regulations also encourage the reduction of duplication through cooperation with state and local agencies including early efforts of joint planning, joint hearings, and joint environmental assessments.

An environmental assessment is not included as part of this plan because it provides a general direction for the water resources program for the Preserve, while specific actions may, or may not, be implemented depending on the availability of funding and staff. Compliance with NEPA will be undertaken for all actions, where appropriate, when it becomes apparent the individual actions, or groups of actions, are likely to be initiated.

National Park Service Management Policies and Guidelines

The National Park Service Management Policies (1988) provide broad policy guidance for the management of National Park System Units. Topics include planning, land protection, natural and cultural resource management, wilderness preservation and management, interpretation and education, special uses of the National Park System Units, facilities design, and concessions management. Recommended procedures for implementing service-wide policy are described in the National Park Service guideline series. The guidelines most directly pertaining to actions affecting water resources include:

- NPS-2, for the Planning process,
- NPS-12, for Compliance with NEPA, including preparation of EIS's, EA's, and categorical exclusions,
- NPS-75, for Natural Resources Inventory and Monitoring,
- NPS-77, for Natural Resource Management, and
- NPS-83 for Public Health Management.

Other Applicable Federal Laws

Water Quality Improvement Act (1970)

This Act requires Federally-regulated activities to have state certification which ensures that water quality standards are not violated.

Endangered Species Act (1973)

The Endangered Species Act requires the National Park Service to identify and promote the conservation of all Federally-listed endangered, threatened, or candidate species within park or preserve boundaries. While not required by legislation, it is a National Park Service policy to also identify state and locally-listed species of concern, and support the preservation and restoration of those species and their habitats.

Safe Drinking Water Act (1974) and Amendments (1986)

The Safe Drinking Water Act is implemented by the state in order to ensure that public water supplies are safe. The National Park Service must comply with state regulations regarding the construction, operation and monitoring of its public water supply systems.

STATE OF FLORIDA STATUTES

The State of Florida has several established programs to help protect resource values both within and outside the Preserve boundaries.

Florida Air and Water Pollution Control Act (Chapter 403, F.S.)

This 1967 Act repealed most of the existing environmental statutes and replaced them with the first real pollution control program. The Act contained a declaration from the legislature to prevent the pollution of air and water in Florida. The Act was codified in Chapter 403 Florida Statutes, and created the Florida Air and Water Pollution Control Commission, consisting of the Governor and Cabinet. The Act was amended in 1971 to require a permit for the construction and operation of every stationary source of water pollution.

Pollutant Discharge Prevention and Control Act (Chapter 376, F.S.)

This 1970 Act authorized the Florida Department of Natural Resources to impose rules concerning methods of materials transfers from ships, to contain and clean up any offshore spills of pollutants, and to charge polluters for clean up costs. This Act also established the Florida Coastal Protection Trust Fund, which uses fees and damage judgements for the administration of the Act.

Florida Environmental Land and Water Management Act

This Act, established in 1972, created the Development of Regional Impact (DRI). This program is designed to address state or regional interest in any "...development which because of its character, magnitude, or location would have a substantial effect upon the health, safety, or welfare of citizens of more then one county."

The Act also enables the Florida legislature the ability to designate Areas of Critical State Concern (ACSC). An area may be designated as ACSC if it:

- contains or has a significant impact on environmental or natural resources of regional or statewide importance;
- contains or has a significant impact on historical or archaeological resources of regional or statewide importance;

- has a significant impact upon, or is significantly impacted by, an existing or proposed major public facility.

The lands within Big Cypress National Preserve were incorporated in the Big Cypress Area of Critical State Concern in 1973.

Land Conservation Act

This 1972 Act was the first major land acquisition program for the state. The program resulted in the issuance of $240 million in state bonds for acquiring environmentally-endangered lands. The objective of the Act was to protect environmentally-unique and irreplaceable lands that are important state ecological resources.

Florida Water Resources Act (Chapter 373, F.S.)

This 1972 Act created six Water Management Districts to address the unique water management problems in the various regions in Florida. Each district is governed by a nine member board appointed by the governor and confirmed by the Senate. The Act established regional administration and comprehensive planning for use of state waters.

Big Cypress Conservation Act

This 1973 Act appropriated $40 million for land acquisition within the proposed "Big Cypress National Fresh Water Reserve". The lands acquired by the state with these funds were donated to the Federal government.

Environmental Reorganization Act (1975)

This 1975 Act created the Florida Department of Environmental Regulation to oversee and centralize environmental regulation. Virtually all regulatory functions created in the 1972 Water Resources Act were delegated to the Water Management Districts.

Safe Drinking Water Act

This Act created in 1977, gave the Florida Department of Environmental Regulation authority to regulate public water systems.

Coastal Management Act

This 1978 Act provided for Florida's participation in the Federal/state partnerships to ensure the wise use and protection of coastal resources authorized under the U.S. National Coastal Zone Management Act of 1972. The state receives Federal funding assistance to implement approved programs and is granted review authority over Federal activities for consistency with the state programs.

Conservation and Recreation Lands Trust Fund (CARL Program)

This fund created in 1979, utilizes money acquired from state severance tax on oil, gas, and solid minerals to purchase lands. Up to $20 million has been collected annually to purchase environmentally-endangered lands; natural floodplains, marshes, and estuaries; or wilderness areas and wildlife management areas; and for the restoration of altered ecosystems. High priority is given to lands in or near counties with high concentrated populations and with Areas of Critical State Concern.

Outstanding Florida Waters (62-302.700 F.A.C.)

As part of the implementation of the Clean Water Act (40 CFR 131.12), this statute grants the Department of Environmental Protection the power to establish rules which provide a category of protection to certain special water bodies, which are intended to prevent any degradation from existing conditions. The two non-degradation categories established under this authority are Outstanding Florida Waters, and the more stringent, Outstanding National Resource Waters. The waters of Big Cypress National Preserve are classified as Outstanding Florida Waters (62-302.700 (2)(g) F.A.C.). Designated waters are to be preserved in a non-degraded state and protected in perpetuity for the benefit of the public.

Under the Outstanding Florida Waters designation, industrial, commercial and residential wastewater discharges (treated or untreated), and dredge & fill operations are prohibited except where clearly in the public interest. Stormwater discharge is permitted only if it has been treated according to strict state standards. Permitting under the Outstanding National Resource Waters designation is more restrictive in that it assumes that the public interest is best served by not permitting any degradation, except in the most extenuating circumstances, and even then, variances, exemptions and changes in classification, can only be granted through legislative action. Because it is so restrictive, an Outstanding National Resource Waters designation can only be granted by the state legislature. In contrast, an Outstanding Florida Waters designation can be granted or modified administratively by the Florida Department of Environmental Protection.

Hazardous Waste Management Act

This Act, established in 1980, created the Florida State Hazardous Waste Management Program to set standards for hazardous waste generators and disposal facilities. This Act adopted Federal definitions of hazardous wastes, established a manifest system for tracking shipments of hazardous wastes (includes generation, transport, storage, treatment and disposal) and created a "clean up" trust fund through an excise tax on waste generators.

Water Management Lands Trust Fund (Section 373.59, F.S.)

This 1981 "Save our Rivers" Trust Fund provided revenues from a documentary stamp tax administered through the Florida Department of Environmental Regulation, and established the Water Management Lands Trust Fund with revenues of approximately $85 million per year from an excise tax on real estate deeds, stock certificates, and other official documents to acquire lands "...necessary for water management, water supply and the conservation and protection of water resources, except... rights-of-way or canals or pipelines...". Lands must be identified in 5-Year Acquisition Plans produced by the Water Management Districts and revised annually.

Stormwater Discharge Regulations (Chapter 17-25, F.A.C.)

This 1982 Florida regulation authorizes the Florida Department of Environmental Regulation to permit stormwater discharge facilities to prevent pollution of waters and to ensure that designated beneficial uses of waters are protected. As instructed by the legislation, the Department of Environmental Regulation has delegated authority for storm water management to the Water Management Districts. This legislation also mandates use of best management practices for construction, erosion and sediment control, and permitting of stormwater discharges with guidelines for use of wetlands.

Water Quality Assurance Act

This Act, established in 1983, moved authority for water well contractor licensing, regulation of storm water runoff, and injection well permitting from the Florida Department of Environmental Regulation to Water Management Districts. However, storm water runoff regulations were moved back to the Department of Environmental Regulation in 1984. The Act gave the Department discretion for delegation of all water management authorities, except state water quality certification for Federal water pollution permits, to the Water Management Districts. It also instructed the Department to generate and compile a database, provide a central depository for all scientific information on ground water, and establish a state-wide ground water monitoring network, created the Pesticide Review Council to comment on restricted use pesticides (a very small fraction of pesticides used in the state), imposed a tax on waste handling to accrue to the local government where the waste facility is located, and changed hazardous waste identification and citing procedures.

Warren S. Henderson Wetlands Protection Act

This 1984 Act consolidated regulation of dredge and fill operations in the Florida Department of Environmental Regulation, and gave the Department jurisdiction over wetlands "up to landward extent of waters" to prevent degradation of water quality below established numerical standards; but exempted certain activities such as irrigation and drainage ditches within an Agricultural Management District.

Surface Water Improvement and Management (SWIM) Act (Chapter 373, F.S.)

This 1987 Act authorizes the Water Management Districts to correct and prevent problems of declining quality of surface waters. This Act also created the SWIM Trust Fund, with monies from appropriations, to help with implementation of restoration plans.

Reuse of Reclaimed Water and Land Application Rules (Chapter 17-610, F.A.C.)

These regulations, established in 1989, instructs the Florida Department of Environmental Regulation to set requirements for wastewater treatment and discharge, including land application, absorption fields, overland flow, wetlands application and injection, to protect beneficial uses of affected waters.

Preservation 2000 Act (Section 259.001, F.S.)

This 1990 Act provides funding to supplement land acquisition programs designed to protect the integrity of ecological systems and provide multiple benefits (including preservation of fish & wildlife habitat, recreation space, and water recharge areas), if lands meet one of five criteria:

- Land in danger of imminent development or subdivision.
- Land value is escalating faster than interest rates.
- Land protects ground water or provides natural resource based recreation.
- Land can be purchased at 80% of appraised value.
- Land has Rare, Threatened or Endangered species or areas listed in Florida Natural Areas Inventory as critically imperiled, rare, or excellent natural communities.

It also requires Water Management Districts to identify lands needed to protect or recharge ground water supplies and include them in Five-Year Acquisition Plans.

Marjory Stoneman Douglas Everglades Protection Act (Section 373.4592, F.S.)

This Act, established in 1991, required the South Florida Water Management District to complete a Surface Water Improvement and Management (SWIM) Plan, to apply for a five-year interim permit from the Florida Department of Environmental Protection to operate water control structures discharging to the Everglades, and to initiate Everglades Agricultural Area regulatory rule making procedures. The Everglades SWIM Plan, completed in 1992, was developed pursuant to this Act and the SWIM Act (Chapter 373, F.S.). The plan outlines overall approaches and guidelines for integrating proposed and existing programs to address various water resource management objectives in the Everglades.

Environmental Reorganization Act (1993)

This 1993 Act created the Florida Department of Environmental Protection by fusing the Florida Department of Natural Resources and the Department of Environmental Regulation. This Act gave the new Florida Department of Environmental Protection responsibility for: management and protection of marine resources including endangered species and their habitats; protection, restoration and management of environmentally important lands and the ecosystems upon them; parks and recreation; water management; and pollution control and environmental protection. Six district offices issue permits, provide information and enforce rules. The Division of Environmental Resource Permitting administers wetlands protection programs through the Bureau of Submerged Lands and Environmental Resources, which reviews applications to use sovereignty submerged lands and is responsible for wetlands dredge and fill permitting. The Division of State Lands, Office of Environmental Services, selects lands to be acquired under CARL. The Division of Water Facilities monitors surface water quality, develops standards, and administers stormwater management through its Bureau of Surface Water Management, and issues rules for wastewater treatment and NPDES permitting through its Bureau of Water Facilities Planning and Regulation. The Department of Environmental Protection has general oversight of the Water Management Districts, and delegates authority for permitting to the Districts except for: industrial, hazardous, solid or domestic waste facilities; marinas; public works projects; navigational dredging; docks and sea walls not included under other development; and activities of the Water Management Districts. The Department of Environmental Protection works with the South Florida Water Management District on a number of programs, including SWIM plans.

Everglades Forever Act (Section 373.4592, F.S.)

The objective of this 1994 Act was to assist in restoring a significant portion of the Everglades ecosystem through implementation of comprehensive and innovative solutions to issues of water quality, water quantity and the invasion of exotic species which face the ecosystem. In response to this Act, the Governor created the Commission for a Sustainable South Florida. This commission is the counterpart to the Federal Interagency Task Force for Everglades Restoration.

Florida Water Quality Legislation

Environmental Control (Chapter 403, F.S.)

This Florida Statute declares it is the policy of the state to ensure that the existing and potential drinking water resources of the state remain free from harmful quantities of contaminants, and outlines data management and inter-agency regulatory cooperation. Two relevant subsections of the legislation are:

- Water Resources Restoration and Preservation Act (Chapter 403, F.S.)

  This legislation includes Sections 403.0615 (Pollution Control) and 403.063 (Groundwater Quality Monitoring).

- Permitting of Activities in Wetlands (Section 403.91, F.S.)

  This legislation defines requirements regarding dredging, filling, wetland monitoring, and mangrove alteration.

CURRENT LAND USE CONSIDERATIONS

Land use considerations in the Preserve fall into three general categories: those resulting from physical occupancy in the Preserve, those resulting from activities associated with permitted uses of the Preserve, and those external to the Preserve. The major land disturbances and general land uses affecting the Preserve are described briefly here. Further details on each are found in the Water Resources Issues section of this plan.

Major Land Disturbances and Uses

Roads, Canals and Levees

Roadways in south Florida often obtain necessary roadfill from excavation of a parallel canal, resulting in both an elevated obstruction to natural drainage patterns and rerouting of flow in open canals. Such drainage alterations in the Preserve include the Tamiami Trail (U.S. Highway 41), Interstate 75 (Alligator Alley), County Route 839 (Turner River Road), County Route 841 (Birdon Road), County Route 94 (Loop Road) and numerous smaller roads. State Route 29, a north-south road, parallels the western boundary just outside of the Preserve, although its borrow canal is just within the boundary of the Preserve. Extending northward from the Tamiami Trail along the eastern boundary of the Preserve, the L-28 levee forms the boundary between the Everglades and Big Cypress drainage. Although the levee is located immediately outside of the Preserve boundary, it is significant to the hydrology of the Preserve. The L-28 Interceptor canal cuts through the extreme northeastern corner of the Preserve. This canal rapidly drains the agriculturally active lands north of the Preserve.

Borrow Pits

Since all structures must be elevated above the seasonal high water levels, fill material must be excavated from borrow pits. Numerous such pits exist within the Preserve, ranging in size and depth, depending upon the extent of the development. One of the most significant borrow areas is associated with the construction of the Dade County Training and Transition Airport just north of the Tamiami Trail and west of the eastern boundary of the Preserve. The Dade County Transition and Training Airport, popularly known as the Jetport, occupies a 32-square-mile area. Construction required 3 million cubic yards of fill excavated from 7 pits, ranging from 30 to 40 feet deep, and covering 65 acres of surface area just west and south of the Jetport runways.

Oil and Gas

Oil and gas are currently produced from two active fields in the Preserve. A portion of the Bear Island field lies within the Okaloacoochee Slough in the northwestern corner of the Preserve. The Raccoon Point field is located in the northeastern corner of the original Preserve and north of the Jetport site.

Dade-Collier Transition and Training Airport

The Dade-Collier Transition and Training Airport, popularly known as the Jetport, occupies a 32-square-mile site just north of the Tamiami Trail and adjacent to the eastern boundary of the Preserve. Although originally intended as an international airport, it is currently used only for limited training activities.

Creosote Contamination at Jerome

Local contamination of the ground water, prior to 1956, by polynuclear aromatic hydrocarbons from a wood-treating facility at Jerome is currently undergoing remediation. The site is located on State Route 29, three miles north of the Tamiami Trail. The site is located within the western Additions and will be acquired under Public Law 100-301.

Non-Federal Lands

Some 38,700 acres, totaling 6 percent of the Preserve's original boundary, are non-Federal lands. These non-Federal lands consist of 12,236 acres of School Board lands consisting of one section in each township set aside for schools, 23,488 acres of Jetport Authority lands, 1,514 acres of county roads, and 1,271 acres of private lands. Non-Federal lands within the Additions have not yet been completely defined.

National Park Service Activities

The National Park Service operates the Preserve headquarters at Ochopee and a visitor and operations center at Oasis. The main components of the Preserve activities are law enforcement, resource management, research, fire management, interpretation, and internal maintenance and administration.

General (Non-Site Specific) Land Uses

Agriculture

Agriculture within the original boundary of the Preserve is minimal. Farming is known to be more extensive within the Additions, but until the lands are formally transferred to the Federal government, these agriculturally-impacted areas will not be completely defined.

Grazing

Five active "life" leases cover grazing rights on approximately 29,000 acres in the northwestern corner of the original Preserve. All leases are located north of Alligator Alley. The leases can only be renewed by the permittee or spouse and are not transferrable. These are gradually being phased out as lessees curtail operations or leases are relinquished.

Off-Road Vehicle Usage

Off-Road vehicle (ORV) usage in the Preserve is regulated by the National Park Service and is permitted by the enabling legislation to the extent that it does not significantly harm the environment.

About two-thirds of the original Preserve is currently open for ORV use. Permits are required; a maximum of 2,500 per year have been established, and areas open to use are designated. The Bear Island Unit, located in the northwestern corner of the Preserve, is restricted to designated trails. Other areas are open to either full or limited use, and two are closed to all ORV use. Airboat and swamp buggy use is mostly during October through March. There has been a general trend toward an increased number of permits annually since 1987.

American Indians

Public Law 93-440 provides that members of the Miccosukee Tribe of Indians of Florida and members of the Seminole Tribe of Florida shall be permitted, subject to reasonable regulations established by the Secretary, to continue their usual and customary use and occupancy of Federal or Federally acquired lands and waters within the Preserve, including hunting, fishing, trapping on a subsistence basis and traditional tribal ceremonies.

External Land Uses

Fakahatchee Strand State Preserve

The Fakahatchee Strand, located just west of the Preserve, is included in the area designated by the State of Florida as an Area of Critical State Concern. It is the recipient of the flow of the Okaloacoochee Slough which cuts across the extreme northwestern corner of the Preserve and crosses under State Route 29 into the strand.

Water Conservation Areas

The Preserve is bounded on the east by Conservation Area 3A which is managed by the South Florida Water Management District. Water is impounded in the Conservation Area and released to Everglades National Park and Big Cypress National Preserve on predetermined schedules. The L-28 levee forms the boundary between Conservation Area 3A and the Preserve.

Everglades National Park

The southern and portions of the eastern boundary of the Preserve abuts Everglades National Park. The Preserve's southern boundary forms a "stair-step" pattern that distinguishes the wetland environment of the Preserve and the estuarine environment of the Park. It is the recipient of flows from the Preserve to the estuarine environment of the Park.

American Indian Reservations

Two American Indian reservations abut the Preserve: that of the Seminole Tribe along the eastern part of the Preserve's northern boundary, and that of the Miccosukee Tribe along the eastern boundary of the Preserve.

Agriculture

A persistent southward progression of agricultural development presents an external threat to the water quality and quantity of the Okaloacoochee Slough and Mullet Slough drainages. Expanding agricultural development is now located along the Preserve's northern boundary.

WATER RESOURCES MANAGEMENT OBJECTIVES

The legislative mandate for the Big Cypress National Preserve, as established in Public Law 93-440, states that the purpose of the Preserve is to "assure the preservation, conservation, and protection of the natural, scenic, hydrologic, floral and faunal, and recreational values of the Big Cypress Watershed....and to provide for the enhancement and public enjoyment thereof....".

THE CHALLENGE

Meeting the purpose for establishing the Preserve includes the following: (1) the management of the natural resources and permitted activities within the Big Cypress National Preserve and (2) involvement in the overall coordinated water resource management of south Florida. Meeting this two-fold challenge will require the identification, preservation, and/or restoration of the natural hydrologic function of the Big Cypress National Preserve and its watershed while also supporting and protecting the natural ecosystems of Everglades National Park, and other adjacent environments.

MANAGEMENT OBJECTIVES

Objectives to meet this challenge are both specific and varied, and are based on current needs and issues facing the Preserve. These objectives are as follows:

Cooperative Management

- Maximize the use of cooperative relationships with Everglades National Park, South Florida Water Management District, U.S. Army Corps of Engineers, U.S. Geological Survey, Miccosukee and Seminole Tribes, local governments, and other entities, to achieve the purposes of the Preserve. In addition, utilize these relationships to contribute substantively to ecosystem restoration efforts and regional water management objectives.

- Protect both the quantity and quality of waters contributed by the Preserve's watershed to Everglades National Park, Water Conservation 3A, and Fakahatchee Strand State Preserve.

Preserve Operations

- Assure that developments and operations of the Preserve do not adversely affect the resources and water-dependent environments of the Preserve.

- Manage uses permitted in the enabling legislation so that adverse impacts to water quality and flow are either minimized or eliminated.

- Promote water conservation through both National Park Service actions, and cooperation with local communities, and state and Federal agencies.

- Promote public awareness and understanding of the importance and function of these significant water resources and their dependent environments.

Inventory and Monitoring

- Monitor aspects of the hydrologic system in order to understand its condition and function, so that these data can be integrated into regional data management systems and regional models.

- Gather and analyze information on quantity and quality of the water resources necessary for the understanding of both historic and present hydrologic conditions.

- Provide for the continual appraisal of current water conditions, assessment of trends, and detection of anomalous changes, support technical studies and provide a necessary basis for informed management decisions.

Water Quality and Quantity

- Maintain, or where needed, restore the naturally-high water quality and historic flows.

- Seek the highest level of protection under Federal and state water quality regulations appropriate for the Preserve.

Wetland Ecosystems

- Recognize the significance of the diversity and function of wetlands, and preserve and/or restore their function, extent, and habitat heterogeneity.

- Promote water management practices that discourage the invasion of exotic species.

- Mitigate the impacts of man-made structures and other physical modifications that cause adverse changes in the natural hydrologic regimen of the Preserve.

Oil and Gas

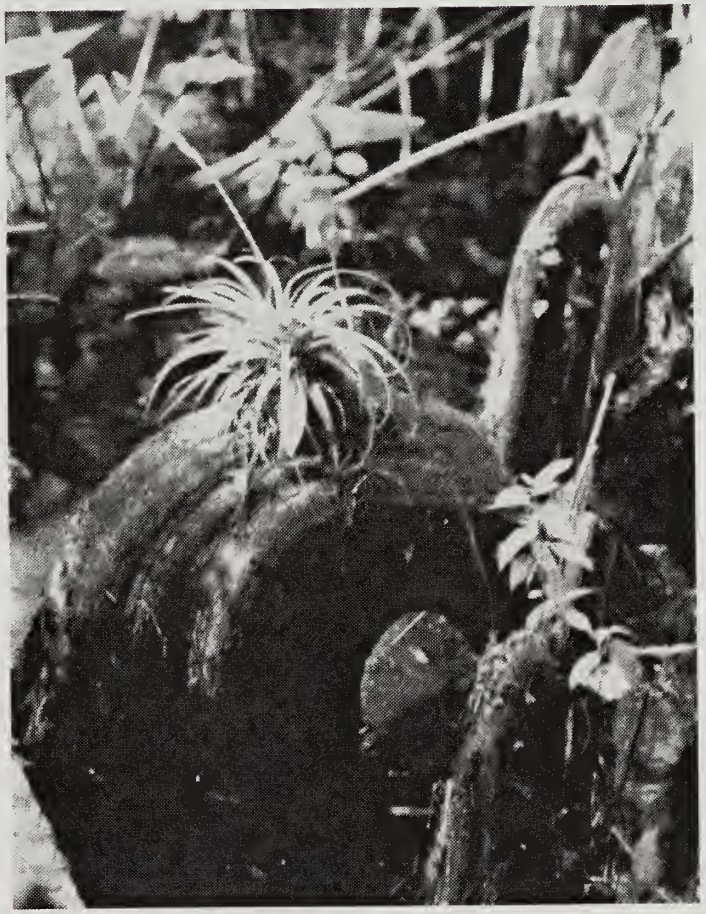
- Ensure that permitted oil and gas exploration and development are accomplished with minimal impact on both surface and ground water resources.

Inundation

- Minimize damage from inundation by adapting Preserve facilities and operations to known fluctuations in water levels.

Fire Management

- Coordinate water resources management and fire management through more efficient information transfer to achieve more natural fire and water regimens.



WATER RESOURCES MANAGEMENT ISSUES

The Big Cypress National Preserve was created in 1974 in response to impending threats, both internal and external, to the water resources of the Big Cypress Swamp and adjacent areas. Over the years, while some threats have been diminished, others have been accelerated and new ones have arisen. The water resources issues facing the Preserve today are both many and varied. They have been developed from a set of issues identified at the National Park Service Workshop in 1993 by a group of 27 individuals from the Preserve, other National Park Service units, and Federal, state, and private interests, all with local knowledge of the Preserve. These individuals are identified in Appendix B.

Attendees at the workshop identified the following as significant issues related to water resources management in the Preserve:

- Coordination with other agencies and organizations
- Limited baseline information
- Lack of geomorphic data
- Limited water resources database
- Limited meteorological database
- Lack of evapotranspiration data
- Limited geologic information and ground water data
- Internal land uses and impacts
- External land uses and impacts
- Eastern boundary water deliveries
- Salinity gradients in canals and estuaries
- Water supply and wastewater disposal

These have been refined and expanded to form the foundation for this Water Resources Management Plan and can be categorized into two general groups: programmatic and specific.

Programmatic issues relate to the need for understanding and management of the Preserve's water resources and the role they play in the overall regional scenarios. This will require long-term monitoring of the water resources, expansion of the baseline information for the Preserve, further understanding of land coverage in the Preserve, and the coordination necessary to fulfill the role of the Preserve in a regional context while protecting its integrity. These items form the core of this Water Resources Management Plan and require long-term commitment and support. The documentation and understanding of water resources gained through this core program provides a necessary foundation for management decisions regarding specific issues, while the specific issues influence the design of the core program, and how it evolves over time.

Specific issues relate to existing activities and problems and can be addressed in context as such. Specific issues are generated by events or actions, and vary widely in scope and impact. They are both internal and external in nature, and require direct responses for alleviation or mitigation.

PROGRAMMATIC ISSUES

The following programmatic issues are considered essential as core features of a Water Resources Management Program for the Preserve:

ISSUE: LONG-TERM HYDROLOGIC MONITORING

Long-term continuous monitoring of the water resources is essential for any area where water is the keystone element of the ecosystem. This is especially true of the Preserve, where the entire area is a fragile wetland environment and water is the dominant controlling factor on the ecosystem. Knowledge of the full spectrum of the hydrologic cycle is essential for rational decision-making in all aspects of management.

Prior to establishment of the Preserve, hydrologic information was limited to water stage data recorded at several nearby sites in Everglades National Park, stage and discharge data obtained by the U.S. Geological Survey along the Tamiami Trail, and several independent studies for special purposes. In 1988, eleven sites were established to monitor water stage and quality. In 1990, the Preserve and the South Florida Water Management District initiated a cooperative agreement which has provided for a substantial upgrade in both equipment and quality of data collection in the Preserve and for compatibility and exchange of water data between the two.

The hydrologic network today consists of 14 sites at which both water stage and water quality are measured (see Figure 3 and Table 1). They were strategically placed to measure both overall baseline conditions in the Preserve and impacts to the water from internal and external threats. The stations are financially supported by the South Florida Water Management District and operated by the Preserve under a five-year Cooperative Agreement. Under the Agreement, the Preserve collects water stage data and water quality samples monthly following a strict Quality Assurance Project Plan approved by the District. The District performs the laboratory analyses on specific water quality parameters for the Preserve. The water stage data collected in the field by the Preserve are also processed by the

TABLE 1

Water Quality and Water Stage Monitoring Stations and Respective Water Quality Parameters
Big Cypress National Preserve

Station	Description	Field Parameters[1]	Lab Parameters[2]	Trace Metals[3]
A1	North Bear Island	X	X	X
A2	East Hinson Marsh	X		
A3	East Crossing Strand	X	X	X
A4	Monument Road	X	X	X
A5	Raccoon Point	X	X	X
A6	Bridge 105	X		
A7	Bridge 84	X		
A8	Bridge 83	X		
A9	Pinecrest	X	X	X
A10	Gum Slough	X	X	X
A11	Roberts Lake Strand	X		
A12	Kissimmee Billy Strand	X	X	X
A13	Mullet Slough	X	X	X
A14	Deep Lake Strand	X	X	X

Notes:

SFWMD station ID's include a "BCNP" prefix.

Water stage data is recorded continuously at each station.

1 - Field parameters (monthly frequency): water temperature, pH, specific conductivity, dissolved oxygen.
2 - Laboratory parameters (bi-monthly frequency): alkalinity, ammonium, calcium, chloride, hardness, magnesium, nitrate, nitrite, orthophosphorus, total phosphorus, potassium, silica, sodium, sulfate, TKN.
3 - Trace metals (quarterly frequency): arsenic, cadmium, copper, lead, mercury, zinc.

District. All hydrological data are made available on the District's DBHYDRO database and the water quality database. The District provides the Preserve with a copy of the water quality and water stage data for its internal resource management needs. The Preserve is also responsible for preparing an annual report to the District's Program Manager by September 30th of each year, summarizing the hydrologic data collected within the Preserve for that fiscal year. In 1995, the District replaced all 12 of the Leupold & Stevens Type A-71 water stage chart recorders with Campbell CR10 data loggers. This upgrade in water stage recorders allows for a more efficient field data retrieval, which will eventually be further modified to a radio telemetering system.

Currently there are seven meteorological stations maintained by the Fire Program in the Preserve. Three of the meteorological stations (North Bear Island, Monument Road, and Gum Slough) are located at sites where surface water stages are recorded. Currently, the U.S. Geological Survey plans to establish one evapotranspiration measurement site in the Preserve.

There are two major gaps in ground water information in the Preserve's hydrologic database. These are:

1. Lack of subsurface water level and water quality data.

2. Limited records from shallow and deep wells for aquifer characteristics.

Water levels are not continuously monitored when the water surface is below ground level. A network of ground water elevations will provide an understanding of flow characteristics in the Shallow and Biscayne Aquifers and may enhance the interpretation of surface flow patterns. These are also necessary for early detection of contaminants introduced below ground surface. Because of the sheet flow conditions that prevail in the Preserve, such contaminants are not likely to mix vertically and could travel undetected in the subsurface for considerable distances.

Expanding demands for water use both west and north of the Preserve require more detailed evaluation of the aquifers to better manage both water quality and availability. Drilling and monitor well installation for hydrogeologic data are currently being undertaken by the South Florida Water Management District, U.S. Geological Survey, and Collier County. An agreement between both the South Florida Water Management District and the U.S. Geological Survey, and the Preserve is being prepared to permit the drilling of test wells at depth to the Shallow and Floridan Aquifers. Further cooperative arrangements for such ground water test wells should be encouraged to permit expanded aquifer evaluation that will promote wise management of the ground water resource.

The existing hydrologic monitoring network in the Preserve meets perhaps a minimal requirement at this time. However, maintaining a program that is adequate to fulfill the future internal needs of the Preserve, and support regional hydrologic efforts, will require periodic reevaluation and significant expansion. Among other factors, this reevaluation should include:

- Monitoring ground water levels and quality
- Adequacy of areal coverage of existing network
- Need for additional monitoring stations
- Adequacy of water quality parameters

ISSUE: BASELINE INFORMATION

Only limited water resources and related information currently exists in the Geographic Information System database for the Preserve. However, substantial amounts of such data exist with other agencies involved in water resources management in south Florida. These data are valuable, and in some instances necessary, for management of the water resources of the Preserve and need to be added to the Geographic Information System database for future use.

Topographic mapping by the U.S. Geological Survey in the early 1950's provided some coverage of the area. Subsequent orthophoto maps of the area prepared in the 1970's were major improvements and were extremely useful in mapping the vegetation of the Preserve (McPherson, 1973) and useful in delineating the northeastern boundary of the original Preserve. Technology, however, dictated limits on the precision of the contour intervals and ground elevations. Current efforts in progress will provide orthophotos of the Preserve on a digital CD-ROM format at a modest cost, with technology available to produce ground contours at 0.5-foot intervals and spot elevations to an average accuracy of 0.1 foot. Such maps are needed for the Preserve. Also available for incorporation into the Geographic Information System database are a set of

aerial photographs taken in the 1940's and a set of soils maps constructed in 1954. Both are useful in evaluating past changes or trends in the water resources of the Preserve.

Oral and written histories from long-time residents often provide a key to an elusive understanding of a recent observation or trend. These can be especially useful when used in conjunction with early photography and maps.

Although a number of highways and roads are located in the Preserve, little is known of the hydraulic characteristics of their numerous bridges and culverts that allow for movement of water, nor of the effects of the roads themselves and their adjacent borrow canals upon the hydrologic regimen of their locations. Roads perpendicular to natural flow directions present impediments to flow that is directed through openings; those parallel to flow patterns enhance rates of flow through their adjacent borrow canals. Detailed data on both the physical and hydraulic characteristics are needed to assess their impacts on flow regimens.

ISSUE: COORDINATION

Located in the Big Cypress Swamp adjacent to the Everglades, the Preserve is a major hydrologic unit in the south Florida ecosystem. Its hydrologic well-being is closely intertwined with that of its neighbors. Their actions affect the Preserve, and the actions of the Preserve, in turn, affect them. Coordination and cooperation with all agencies, organizations and Tribes involved in the water resources of south Florida is essential in keeping the Preserve fully aware of all activities and actions that may affect them. It also serves as a mechanism for representing interests of the Preserve in the complex and, at times, overlapping and seemingly contradictory efforts at water management.

Coordination is especially important where hydrologic interdependence exists between the Preserve and its neighbors. Hydrologic interdependence exists between the Preserve and both Water Conservation Area 3A and Everglades National Park to its east and south. The southeastward flow through Mullet Slough, in the northeastern Additions of the Preserve, flows directly into Conservation Area 3A. Water releases from this Conservation Area enters the Preserve and Everglades National Park, with the majority of this recharge flowing through Everglades National Park and then across the southeastern corner of the Preserve and into the estuarine environment of the Park. Releases from Conservation Area 3A also flow across Tamiami Canal at the water control structures, with water free to flow westward in the canal into the Preserve. Currently, releases from the Conservation Area are made through the four S-12 structures, the S-14 structure, and the S-343A and S-343B structures (see Figure 3) based on a rain-driven hydrologic model that varies releases in response to rainfall. Neither the extent nor the impact of this hydrologic diversion is fully understood. The controlled releases from the Conservation Area are governed by an agreement between Everglades National Park and the South Florida Water Management District, which directly affect water levels in the vicinity of Loop Road. Efforts were initiated in 1995 by Monroe County and the Preserve to improve the flow under Loop Road with additional culverting.

Participation in the state's permitting process by the Preserve is important toward achieving protection of the Preserve's water resources. Examples of active involvement by the National Park Service include permit approval, requested monitoring and/or mitigation measures, or in extreme cases permit denial.

Hydrologic interdependence also exists between the Preserve and the Seminole Tribal lands along the eastern part of the Preserve's northern boundary. The West Feeder Canal constructed in the 1960's flows eastward across the middle of the Reservation and diverts water formerly flowing into the Preserve to Conservation Area 3A. A water management plan under consideration by the Tribe proposes to reestablish hydrologic connections across the canal to the two sloughs that flow into the Preserve's northeastern Additions (Seminole Tribe of Florida, 1995).

The focus on broad, regional management of water resources in south Florida inherently requires that management of water resources in the Preserve be compatible, to the extent possible under the mandates of the enabling legislation, with the ongoing efforts of other agencies and organizations. Coordination with these entities has a two-fold purpose: (1) to protect the Preserve's mandated management of the waters in the Preserve, and (2) to provide, as fully as possible, both cooperation and input to regional issues and problems.

Numerous efforts currently are focused on identifying, modifying and/or correcting alterations to the natural ecosystem that have occurred over the years. Among these are:

- The efforts of the Interagency Working Group formed in 1993 under a five-year Federal Interagency Agreement on South Florida Ecosystem Restoration to coordinate all Federal efforts toward restoration.

- The U.S. Army Corps of Engineers Comprehensive Review Study begun in 1992 to determine the feasibility of structural or operational modifications to the central and south Florida project essential to restoration of the south Florida ecosystems.

- The Central and South Florida Water Management District's development of regional- and county-level water supply plans to provide for better management of south Florida's water resources.

- Everglades National Park's efforts in development of a model for better management of releases to support the ecosystems of the Park.

- The U.S. Geological Survey's efforts as part of its National Water Quality Assessment (NAWQA) Program in its assessment of the water quality of the total south Florida ecosystems.

- The Seminole Tribe of Florida's conceptual water conservation system design on the Big Cypress Reservation as its contribution to the South Florida Ecosystems Restoration effort.

There is need within the Preserve to bring its hydrologic database current and in a format compatible with and accessible by other users of the data. There is also need to constantly evaluate the data network in the Preserve to insure adequacy for its own internal management needs as well as the needs of others. Ongoing hydrologic modeling efforts, especially those of the South Florida Water Management District, the U.S. Army Corps of Engineers, and Everglades National Park are likely to require additional data for verification and refinement. It is in the interest of the Preserve, both as a major component of the overall south Florida ecosystem and for the enhancement of its own database, to cooperate fully in the acquisition of these data.

Many other activities within the Preserve will require coordination to achieve their purposes. These include coordination efforts with the State of Florida on the Fakahatchee Strand State Preserve, with Monroe and Collier Counties and the Florida Department of Transportation on roads and highways in the Preserve, and numerous other Federal, state, and local government entities as well as private and public organizations having interest in the activities of the Preserve.

ISSUE: LONG-TERM LAND USE MONITORING

Continually-changing land use activities both in and adjacent to the Preserve require monitoring for control and management of their impacts on the water resources. Detection of the changes through monitoring can provide early warning of deleterious impacts on the ecosystem and its water resource component.

Throughout the Preserve, there are areas under private control or abandoned that exhibit characteristics of their former use. Most recent estimates of occupancy have identified about 250 "improved" sites, which include houses and trailers. Approximately 500 former trespass campsites are also located in the original Preserve. In addition to this occupancy, there are pockets of land that show the effect of past land practices that include farming, cattle-raising, timber harvesting, oil and gas exploration and production, concentrated recreational activities, and abandoned homes and campsites. The impact of the existing occupied sites on both the flow and quality of water cannot be adequately determined at this time. Monitoring of the sites for physical changes can provide early warning and detection of deleterious impacts before major damages occur to the ecosystem and its water resources component.

Changing land uses in the American Indian Reservations, the southward progression of agriculture into the Okaloacoochee and Mullet Slough areas and activities in villages and commercial establishments in proximity of the Preserve also require monitoring to determine potential as well as immediate threats to the long-term integrity of the waters of the Preserve.

SPECIFIC ISSUES

Both external and internal land uses and activities affect both the flows and quality of waters within the Preserve. They represent the most pressing issues that the Preserve will face in both the near and distant future. They also represent a series of activities over which the Preserve has little or no direct control.

The following are identified as the significant externally-related specific issues within the Preserve:

ISSUE: AGRICULTURE

Agriculture practices are prevalent just north of the Preserve in the Okaloacoochee Slough, Mullet Slough, and Kissimmee Billy Strand watersheds which drain directly into the Preserve. Agriculture in these areas represents a potential source of pollution from pesticides and fertilizers that are transported into the Preserve either through ground water flow or surface water flows in Mullet and Okaloacoochee Sloughs and the Barron River and L-28 Interceptor Canals. The existing water resources monitoring network will need to be expanded to include data essential to monitor trends in water quality and quantity, and for early detection of impacts.

North of the Preserve, there is a southward progression of agricultural development which in Hendry County are now along the northern border of the Preserve. Following devastating freezes in the 1980's, there was a major shift in citrus production as growers, seeking to reduce the risk of freeze damage, moved southward into Hendry and parts of Glade and Collier Counties. Between 1980 and 1990, citrus acreage doubled to 150,000 acres (Mazzotti, et al., 1992) and is projected to reach 200,000 acres by the year 2000 replacing mostly range and pasture lands.

Water use permits from the South Florida Water Management District are required for citrus grove development. Applications must include detailed plans which are subject to engineering and environmental review under its Surface Water Management Permit Process (Mazzotti, et al., 1992). As of 1990, a number of permits, which include citrus production, have been issued for tracts north of the Preserve. The local "consumptive use" and "surface water" permits north of the Preserve are shown in Figure 12. The "consumptive use" permits regulate withdrawal of surface water or ground water. The "surface water" permits regulate the amount of water discharged off the property.

The introduction of citrus in proximity to the Preserve is of particular significance because of the irrigation necessary to sustain the groves in the dry season when the fruits are maturing. Pumping of ground water or diversion of surface water alters the natural hydrologic relationships which, in proximity to the Preserve may alter natural flow patterns within its boundaries. Water quality is also of concern because of the persistent use of fertilizers, pesticides, and fungicides in the groves. This projected growth of citrus production into drainage areas adjacent to and flowing into the Preserve presents a potentially serious threat to the integrity of the quality of waters entering its boundaries from the pesticides and fertilizers associated with their production.

ISSUE: INDIAN LAND USE ON TRIBAL LANDS

Potential impacts on the water resources of the Preserve could likely occur as a result of potential changes resulting in present land use practices of the Seminole and Miccosukee Tribes of Florida. Changes in land uses in either reservation may impact flows entering the Preserve.

This is especially true of potential changes in land use on the Seminole's Big Cypress Reservation. The Seminole Tribe, in response to its participation in the Everglades Restoration Project, have negotiated with the South Florida Water Management District to provide the Tribe with an alternate source of water to protect its Compact right to water, and has developed a conceptual plan to meet both anticipated new water quality standards and its needs for internal economic activities. Included in the plan is restoration of surface flows from designated Water Resource Areas to the Preserve through breaches in the West Feeder Canal that traverses the Reservation and from flows from Water Resource Areas between the L-28 Interceptor canal and L-28 levee that would flow directly southward into the Preserve. Discharges from this project could be a positive factor in maintaining or restoring natural hydroperiods in the northeastern corner of the Preserve.

Water management objectives of the Miccosukee Tribe of Indians of Florida are generally consistent with those of the Preserve. A planned return to pre-drainage water quality standards will benefit the Preserve. However, the effects of water stages sought by the Tribe on surface water flows in the Preserve are not yet clear. Achieving management objectives may affect releases from Conservation Area 3A through modifications to the L-28 levee and must be evaluated.

ISSUE: SALINITY GRADIENTS IN CANALS AND ESTUARIES

A significant length of Florida's Gulf Coast has been affected by altered patterns of fresh water inflows from borrow canals adjacent to north-south roads in the Preserve. The rapid drainage created by these borrow canals modify the salinity gradients in the estuarine

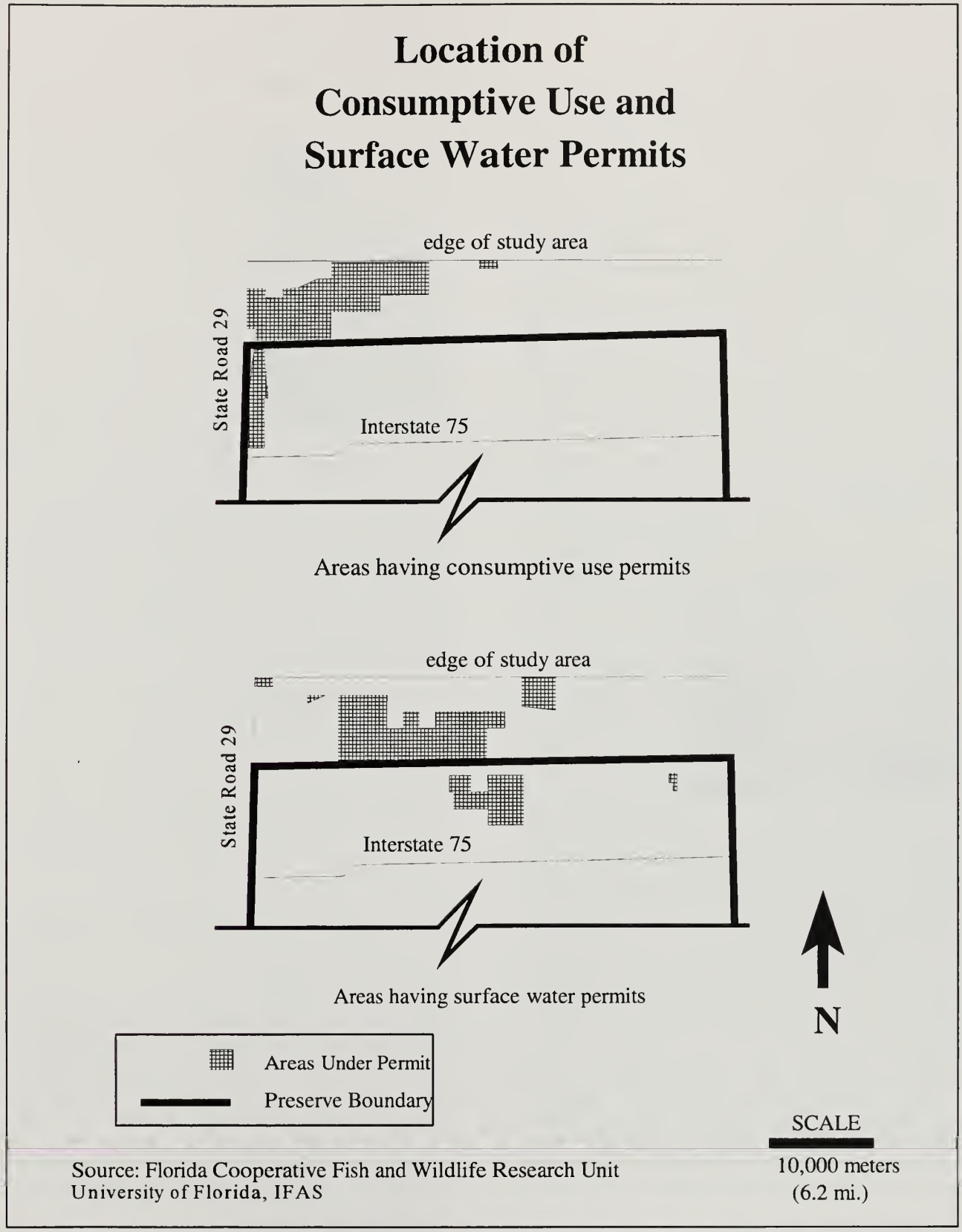


Figure 12. Consumptive Water Use and Surface Water Permit Locations.

environments with resultant impacts on both fisheries and biota. Modifications to natural flow regimens of the Preserve from releases of water from Conservation Area 3A also affect the salinity gradients of estuaries within Everglades National Park.

No data are available to assess the relationship of the fresh water flow from the Preserve to the estuarine environment of the Park. As part of its marine research and monitoring activities, Everglades National Park has established 13 sites to document stage, water movement, and salinity in this estuarine environment fed by freshwater flows from the Preserve. Hydrologic data on these freshwater flows will be necessary to understand the relationships that govern the salinity gradients vital to the well-being of the estuaries and bays.

The following are identified as the significant internally-related specific issues within the Preserve:

ISSUE: DADE-COLLIER COUNTY TRANSITION AND TRAINING AIRPORT AND L-28 LEVEE

Although the L-28 levee and its "tieback" extension are not within the Preserve boundary, their relationship to the Jetport warrants consideration with it as an issue. The physical infra-structure of the Jetport site, with its roads, runways, and large borrow pits are significant factors in the flow patterns of the northeastern part of the Preserve. Especially significant are the 10,500-foot runway and taxiway with their ramps and aprons on 80 acres of fill near perpendicular to the normal flow in the area. The levee was constructed to confine the Everglades water flows to Water Conservation Area 3A and to subsequently lower the water level to the west, including the Jetport.

Options are now under consideration (U.S. Army Corps of Engineers, Central and Southern Florida Project, Comprehensive Review Study) which could modify the L-28 levee and canal system with resultant changes to the local flow regimen at the Jetport site.

ISSUE: OIL AND GAS

Although several oil fields have been developed along the Sunniland Trend in the past, only two fields, Bear Island and Raccoon Point, remain in production. The entire Raccoon Point oil field is located within the Preserve, while only a portion of the North Bear Island oil field is located within the Preserve. There are 37 abandoned oil and gas sites scattered across the Preserve consisting primarily of access roads and pad sites. Also in the Preserve are 22 miles of common carrier pipeline, which continues east from the Preserve and transports crude oil to Port Everglades on the east coast of Florida. Although the Bear Island and Raccoon Point fields are the only actively-producing fields in the Preserve, the likelihood of future development exists, particularly along the Sunniland Trend. Sources of impacts on the water resources include the following:

- Elevated well pads for the drilling and operation of the oil wells constructed from fill material outside the Preserve.
- Elevated access roads to the well fields, also from fill material outside the Preserve.
- Potential oil spills resulting from exploration and production, and damage to the pipeline.
- Potential brine spills from malfunctioning of the brine reinjection process.

Operational oversight consists of monitoring and compliance. New operational procedures include fluid containment systems and a closed recycling system that eliminates the need for reserve pits. At the present rate of development, oil and gas operations in the Preserve are likely to have minimal local effects on the water resources if surveillance is employed regularly and compliance with regulations is enforced. However, an accelerated rate of development could significantly stress water resources locally.

ISSUE: TRADITIONAL INDIAN USES IN THE PRESERVE

Land occupancy within the Preserve by the Miccosukee Tribe of Indians of Florida currently consists of 11 villages, each consisting of 10 structures or less on less than two acres of land located along the Tamiami Trail (Goss, 1994). Little or no survey data are available on the sites or their local impacts on the water resources.

The Miccosukee and Seminole tribal use of the Preserve's natural resources are limited (Duever, et al., 1986). Currently, the resident American Indians in general, do not hunt, fish or farm to any great extent. Their predominant use of the resources is the gathering of native materials, particularly cypress and cabbage palm fronds, for chickee construction and for objects sold as souvenirs to tourists. Chickee construction has become a commercial enterprise. Live cypress trees are harvested for poles used in chickee construction. Most are cut from roadside areas. Although the harvest is limited at this time, an increase in commercial chickee construction could result in over harvesting, particularly in easily-accessible areas of the Preserve. Such concentrated harvesting could result in local disturbances to the land surface that may modify the water regimen in the immediate area.

Tribal uses of the Preserve for traditional ceremonies, is limited to the use of selected hammocks for short durations of a few days several times each year. Limited clearing and construction of 80 to 90 chickees for the ceremonies coupled with the human use of the area may have some influence locally on the water resources.

Tribal members and individual American Indians have explored the potential for reoccupying former camp and village sites primarily along improved roads. The Miccosukee Tribe of Indians of Florida has submitted a proposal to construct 65 homes, 64 of which are along Loop Road within the boundaries of Everglades National Park (Miccosukee Tribe of Indians of Florida, 1995). Water resource issues of consequence include, but are not limited to water quality, adequate sewage treatment facilities, and potable water systems.

ISSUE: WETLAND RESTORATION

Since the late 1980's, funding for restoration of wetlands has been available through the Florida Department of Environmental Protection as grants from the Pollution Recovery Trust Fund. Wetland restoration support has also consisted of services from individual violators of state wetland regulations in lieu of cash payments to the Trust Fund.

Restoration in the Preserve, through these "in-kind" services has resulted to date in up to $1.0 million of effort in restoring wetlands, improving culvert drainage, and reducing drainage capabilities in canals. These efforts have resulted in restoration of natural hydroperiods to as much as 150 acres of filled wetlands, improvement of drainage in the Bear Island Unit through the installation of 32 culverts, and enhancement of the Turner River restoration by the installation of culverts under Wagon Wheel Road and Turner River Road.

Current efforts toward the mitigation of the impact of Loop Road on surface flows is being accomplished through cooperative efforts between Monroe County, U.S. Army Corps of Engineers, South Florida Water Management District and the National Park Service. A culverting project, initiated in 1995, has reduced the flooding problems along a section of Loop Road and enhanced the restoration of the natural flow regimen in the area.

The continued use of grants and "in-kind" services from the Pollution Recovery Trust Fund and services and support activities from government and private entities offers a cost-effective means of achieving the management goals of the Preserve to maximize restoration and protection of its wetlands.

ISSUE: NON-FEDERAL LANDS

Public Law 93-440 and Public Law 100-301 provided for continued non-Federal ownership in the Preserve, which consist of lands under ownership by other than the Federal government. Under the laws, no properties improved prior to November 23, 1971 can be acquired by the Federal government unless the owner agrees to the acquisition. Approximately 38,709 acres comprising approximately six percent of the original Preserve, consist of townships under control of local school boards, the Jetport site under control of the Dade County Port Authority, state and county roads, and privately owned tracts. It is the intent of the National Park Service to incorporate these lands, as feasible, into the Preserve by donation or purchase.

Most significant of the non-Federal lands to the integrity of the water resources are the 1,271 acres that are in privately-owned tracts concentrated mainly along the

Tamiami Trail and in enclaves along state and county roads intersecting the Trail. These private properties are subject to local building codes and ordinances, and because of their remoteness are only minimally monitored by local regulatory agencies for compliance.

The management of the Preserve has no direct authority over non-Federal lands, and is dependent upon local authorities for direct control and compliance to codes and regulations. Local zoning, though compatible with local governmental objectives, may not be compatible with resource management programs of the Preserve. Zoning upgrades or exemptions such as residential development could be completely antithetic to the Preserve's mandate for protection of the natural ecosystem. Although local zoning activities are available, they do not provide the Preserve with the tools necessary to protect it from incompatible uses of private lands with their inherent cumulative effects on the water resources of the Preserve.

ISSUE: OFF-ROAD VEHICLES

The various permitted off-road vehicles (ORV's) consist of all-terrain vehicles, airboats, swamp buggies, and four-wheel drive street-legal vehicles. The increased use in ORV's is resulting in increasing disturbances to vegetation and soils in the Preserve. Comparisons of current and past aerial photography indicates both damage and permanent changes in the land surface. Although only limited studies have been conducted, studies have shown that some ORV use results in soil displacement with no natural mechanism capable of restoring the natural topography (Duever, et al., 1986). Preliminary field investigations in 1995 of airboat impacts on the local flow regimen in the Preserve suggest that some airboat trails alter both direction and velocity of the local surface water flows. Additional documentation of ORV impacts on sheet flow is needed to assess more fully their impacts on the normal flow patterns of the Preserve.

ISSUE: SPECIAL WATERS DESIGNATIONS

Water quality designations of the state of Florida offer an opportunity to strengthen the protection of water quality in the Preserve. The waters of the Preserve are currently classified as Outstanding Florida Waters due to their exceptional recreational and ecological significance (Florida Administrative Code, 62-302.700). Outstanding Florida Waters is one of two non-degradation designations provided under Florida Law. The other designation is Outstanding National Resource Waters, which provides the highest level of protection available under the Clean Water Act (40 CFR 131.12).

These two non-degradation classifications, which as a group are called "Special Waters", are designed to maintain existing high water quality. In contrast, all of the other water quality standards are based on protected uses, which allow discharges that degrade water quality so long as the quality remains sufficient to not preclude the designated uses. Special Waters classifications call for the establishment of baseline water quality conditions, and, with few exceptions, prohibit the issuance of permits for activities that would degrade water quality from that baseline. The Outstanding Florida Waters designation is more lenient toward minor temporary discharges during construction or for actions to enhance public use or to maintain pre-existing facilities than the Outstanding National Resource Waters designation. Exceptions for projects under Outstanding National Resource Waters are more restrictive, and limited to discharges exempted by statute, and discharges that will clearly enhance water quality. Under either an Outstanding Florida Waters or Outstanding National Resource Waters designation, any proposed new permits, or modification of existing permits will have to meet the strict non-degradation standards.

An Outstanding National Resource Waters designation can only be granted by the state legislature, after an administrative procedure to evaluate the need, and costs and benefits of such a designation. In contrast, an Outstanding Florida Waters designation can be made through administrative action. The significance is that it is much more burdensome to achieve an Outstanding National Resource Waters designation, but also that it provides a greater level of protection because the classification cannot be changed without legislative action, nor can exemptions or variances be granted except by the legislature.

The Preserve will seek an Outstanding National Resource Waters designation to further protect the water quality of the Preserve, giving it the same level of protection as defined in the Florida Administrative Code for Everglades and Biscayne National Parks. Such protection will be particularly valuable because the existing water quality of the Preserve is generally thought to be excellent, and more closely represents natural conditions than any other waters in south Florida. These waters are also contained within the watershed of Everglades National Park. Prior to making a request to the Florida Department of Environmental Protection to initiate the designation process, the Preserve will have to evaluate the effects of such a designation on Preserve operations, consider appropriate boundaries for such a designation, and consider the most appropriate baseline period. The Department of Environmental Protection and Florida Legislature will have final authority over boundaries and baseline period, but it is important that the position of the Preserve be provided to them.

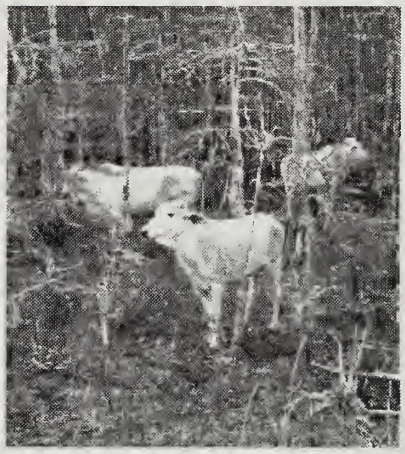
ISSUE: MERCURY

Since its first detection in 1989, mercury in the south Florida ecosystem has become a major source of concern. Human health advisories by the State of Florida recommended limited or no consumption of fishes from over two million acres, including the Preserve. Analyses of water samples from the Preserve's eleven water quality monitoring stations in 1988 showed a concentrations of 0.6 µg/l at one site located in the northern portion of the Preserve, exceeding the Florida Department of Environmental Protection's Class III (1988) water quality limit of 0.2 µg/l. Ten largemouth bass were collected in 1989 from the L-28 Levee and L-28 Interceptor canals and analyzed for mercury. Mercury was detected in the tissue of all ten fish, with concentrations ranging from 0.505 mg/kg to 2.910 mg/kg. Mercury concentrations exceeded the FDA recommended consumption level of 1.0 mg/kg in four of the five fish collected from the L-28 canal. Analytical results of mercury concentrations in fish were also reported by the Florida Game and Fresh Water Fish Commission in 1992 from three species of fish (large mouth bass, bowfin & gar) collected from the L-28 Interceptor canal. Mercury concentrations ranged from 0.70 mg/kg to 2.01 mg/kg for six largemouth bass, 1.45 mg/kg and 3.25 mg/kg for two bowfin, and 0.65 mg/kg to 1.80 mg/kg for four gar.

A high concentration of mercury (110 mg/kg) was detected in the liver of a Florida Panther that died in the Everglades in 1989. No definitive cause of death was identified, but mercury toxicosis is suspected. Analysis of various tissue samples from other dead panthers recovered since 1978 also contained elevated mercury levels (Florida Panther Interagency Committee, 1989). Additional wildlife studies are on-going to further evaluate the extent of the mercury problem.

A study by the U.S. Environmental Protection Agency is currently underway to address the problem of mercury throughout the Big Cypress and Everglades region. The study objectives include further defining the extent of mercury contamination in various media, determining mercury sources, and performing ecological risk assessments. Mercury sampling efforts in south Florida by the U.S. Geological Survey are also ongoing. The Preserve has provided a supportive role in these important regional projects.

ISSUE: GRAZING



Currently, five leaseholders have grazing rights on approximately 29,000 acres in the northwestern corner of the original Preserve, covering land north of Alligator Alley. The extent, location, and status of grazing leases in the Additions are not known at this time. Although the conveyance of lands from Collier Enterprises, Collier Development Corporation, Barron Collier Company, and the State of Florida should be accomplished by 1996, the acquisition of private lands will likely take many years.

All existing leases date from prior to the establishment of the Preserve, and can be renewed only by the permittee or spouse. They are not transferable, and are being phased out gradually as existing lessees end operations. Because acquisition of private lands in the Additions will likely take many years, it is quite possible that grazing in the Additions could continue for an extended period.

The impacts of cattle on the water resources of the Preserve have not been studied. The relatively low stocking rate would seem to indicate limited impacts on the water resources. Temporary increases in cattle concentration may occur during local high water conditions, thus increasing the potential for local water quality impacts.

ISSUE: ABANDONED AGRICULTURAL LANDS IN THE PRESERVE

There are no significant farming activities within the original boundary of the Preserve, although evidence of abandoned fields can be found predominately north of Alligator Alley, west from Monroe Station along the Tamiami Trail, and in the Ochopee area between County Route 841 and State Route 29. The abandoned areas in the Ochopee area especially show drastic alterations to the natural environment from invasion of both exotic and native shrubs and trees. Farming is known to be more extensive in the Additions, but until the land is formally conveyed to the Federal government, the Preserve cannot attempt to manage or restore these lands.

ISSUE: UNDERGROUND STORAGE TANKS

The establishment of the Preserve brought with it a number of underground storage tanks (USTs) at locations both known and unknown. In 1991, efforts were initiated to remove USTs from four sites, of which three -- Paolita Station and Monroe Station on the Tamiami Trail, and Turner River Bar on Turner River Road -- were inactive, and one at the Preserve's Visitor Center at Oasis was still in use.

The three tanks at the inactive sites were removed by a certified contractor in 1992. No contamination of the soil was found at the Turner River Bar and Monroe Station sites. Contaminated soil was found, however, at Paolita Station. After removal of the contaminated soil, the rehabilitation was approved by the Florida Department of Environmental Protection in 1995. Contaminated soils were also detected during removal of the tank at the Oasis Visitor Center, and remedial approaches are under consideration. A Contamination Assessment Report on the site currently is under review by the Florida Department of Environmental Protection.

The Preserve does not have a comprehensive inventory of existing USTs within its boundaries. State requirements for proper UST registration and closure are specific. Several activities in the Preserve that require the use of fuels suggest the strong possibility that not all USTs have been identified to date. It will be necessary to identify these USTs and either have them properly upgraded or closed by the responsible party.

ISSUE: CREOSOTE CONTAMINATION AT JEROME

Creosote contamination of soil and ground water resulting from a former wood treatment facility at Jerome is currently being remediated. Contaminated soils have been removed from the site and the proposed ground water remediation is currently under review by the Florida Department of Environmental Protection. Polynuclear aromatic hydrocarbon contamination was detected in local private water wells by the Collier County Pollution Control Department in 1989. The property is scheduled for transfer to Federal ownership as part of the transfer of a major portion of the Additions to the Preserve under Public Law 100-301. It is the intent of the Preserve not to accept the lands until remediation is completed.

ISSUE: NATIONAL PARK SERVICE DOMESTIC WATER SUPPLY AND WASTEWATER DISPOSAL SYSTEMS

Nine residential wells and two public water systems supply the domestic needs of the Park Service facilities within the Preserve with ground water from the Shallow Aquifer. Public water systems supply the Oasis Visitor Center and the Ochopee Headquarters and Lodge living quarters. Water samples for analyses are collected on a regular schedule and forwarded to the Florida Health and Rehabilitative Services laboratory in Miami for testing.

Approximately 30 septic systems with anaerobic leach fields serve the Preserve's headquarters and residential quarters, camp grounds, and the Oasis Visitor Center. As repairs are made to the systems, they are upgraded to meet the current standards of the Florida Health and Rehabilitative Service. A wastewater treatment plant with a 15,000 gallon-per-day capacity serves the Headquarters and Lodge at Ochopee.

WATER RESOURCES MANAGEMENT PROGRAM

The mere size of the Big Cypress National Preserve -- 729,000 acres, most of which are wetlands -- dictates the necessity for a comprehensive water resources management program to protect the integrity of its relatively pristine environment, as mandated in its enabling legislation. Coupled with this are the numerous internal and external threats to the water resources, which attest to the urgent need for a coordinated and supported plan to implement this program.

The Preserve is a key component in the ongoing multi-agency South Florida Everglades Restoration Program. Unfortunately, the Preserve's historical database and activities are less than minimal to manage its own internal threats to its water resources, much less to meet its obligations as a component in the broader regional context. The Preserve today is comparable to the position of Everglades National Park in the 1950's and 1960's when it faced serious threats to its hydrologic integrity, yet had a very limited information base.

The Current Hydrology Program

The Preserve's monitoring stations and the specific water quality parameters analyzed at each station are identified in Table 1. This monitoring network is, at best, only minimally adequate to provide the Preserve with the level of information needed for responsible management of its water resources.

The Need for a Dynamic Program

The history of hydrologic monitoring in the Preserve over the past two decades has left the Preserve today with a hydrological database that lacks current and organized information. There was little urgency during the 1970's and 1980's to establish a competent hydrologic program because of the relative isolation of the Preserve as an essentially self-contained watershed, and the growing urgency of the hydrologic problems of the Everglades. However, as the Preserve's boundaries expanded and the growing recognition of the Everglades as a component of a greater south Florida ecosystem developed, the recognition of the Preserve's role also become apparent.

The recognized complexity and extent of water management problems are attested to by the number and scope of Federal, state, and local agencies directly involved in the associated water resources problems. Federal agencies include, among others, the U.S. Army Corps of Engineers, which physically manages the water control operations of the Central and Southern Florida Project; Everglades National Park, as the recipient of necessary releases from the Conservation Areas, the U.S. Geological Survey which monitors surface water and ground water at sites throughout south Florida; and the Interagency Work Group and Task Force on the South Florida Ecosystem Restoration. State agencies include the South Florida Water Management District, a district organized under charter from the State of Florida; the Florida Department of Environmental Protection, which enforces water quality standards; and the Governor's Everglades Restoration Commission for a Sustainable South Florida, which aims to restore the original Everglades to more nearly its former natural condition. The Preserve, because of its size, its strategic location, the importance of its water resources, and its interrelationships in overall water management in south Florida, must be a major component of this complex system.

Until recently, the Preserve, with its inadequate staffing and budget support for water resources, has been forced to play a reactive role in these regional and interagency activities. Although its philosophy and attitude were proactive, its active participation was limited by a lack of staff and basic information. Even the ability of the Preserve to meet its internal needs was similarly limited. The Preserve recognizes that it cannot carry out its mandated responsibilities in protecting its water resources in isolation from decisions of its neighbors affecting the overall south Florida ecosystems. The development of this comprehensive Water Resources Management Plan is evidence of the Preserve's recognition of its commitment to fulfilling its role of protecting the relatively pristine waters of the Preserve as a part of the larger south Florida ecosystem.

As recognition grew in the 1990's of the interdependence of water management for the restoration and protection of the south Florida ecosystem, the Preserve has emerged as a significant component of this effort, and requires a dynamic program that will not only meet its internal needs but also enable it to play an active role in the regional context. Currently, because of budgetary and staffing constraints, the Preserve can play only a limited, but supportive, role. Enactment of this program is essential to fulfill both the Preserve's legislative commitment to protect the integrity of the Preserve and its responsibility as a significant component of an equally-important objective -- responsible management of the overall water resources of the entire south Florida ecosystem.

THE NUCLEUS OF THE PROGRAM

This Water Resources Management Plan provides for a program with five identifiable components listed below, which are considered the nucleus of the Preserve's hydrology program:

- Inventory and Monitoring
- Cooperation and Coordination
- Data Management
- Specific Water Resources Issues
- Staff and Support Needs

The first three components focus primarily on aspects of the hydrology program. They are critical to understanding the hydrological system of the Preserve and surrounding lands. With this understanding, it will be possible to address the broader range of specific water resource issues in the fourth component. The fifth component defines the adequate staffing needs and expertise necessary to support these four components of the program.

Thirty proposed projects have been developed from these five components, representing an appraisal of actions needed at this time. They are identified as project statements throughout this Water Resources Management Plan, and are presented in Appendix A. Each project statement addresses a water-related problem and the respective actions required for its solution. Project statements are standard National Park Service programming documents that can be included in the Natural and Cultural Resources Management Plan for the Preserve. While these project statements include actions that can be implemented now without additional funds or staff, their primary purpose is to compete with other National Park Service units for additional support.

The proposed projects range from urgent actions that should be accomplished in the near-term, to long-term commitments such as enhancement of the hydrologic monitoring network, to singularly specific items such as removal of underground storage tanks. Many of the projects serve dual roles in that their activities support multiple components of the proposed program. Fourteen projects are long-term core activities relating to inventory and monitoring, cooperation and coordination, and data management. Sixteen projects address specific water related issues.

Inventory and Monitoring

The purpose of the hydrologic monitoring program at Big Cypress National Preserve is to:

> *Provide for the continual appraisal of current water conditions, assessment of trends, detection of anomalous changes, and support technical studies; and provide a necessary basis for informed management decisions.*

Monitoring of the Preserve's water resources requires a long-term, sustained base program. It is highly desirable to expand the current program within the Preserve to a level that is compatible with hydrologic data programs of other Federal and state agencies in south Florida, including those of the U.S. Geological Survey, U.S. Army Corps of Engineers, South Florida Water Management District, and Everglades National Park.

The highest priority for the monitoring program is to continue the existing program at its present level, evaluate its efficiency, and provide for limited modifications in response to current high-priority issues. Maintaining the continuity and improving the quality of the existing monitoring network is very important because, though it has serious limitations, it provides the best available assessment of conditions in the Preserve.

In recognition of the limitations of the current monitoring program, a major review of the hydrologic monitoring network in the Preserve is required. Some of the inadequacies of the current network are readily apparent, such as the Additions to the Preserve, changing pressures from internal and external activities, and major changes in water management practices in south Florida currently under consideration; some of which appear imminent. Other possible shortcomings of the network are less apparent, such as whether existing sites are truly representative of some portion of the Preserve, or capture impacts from some local activity. These will likely remain undetected until the proposed evaluation is conducted. This will require an increase in staff and base funding devoted to this program.

The monitoring program can also be enhanced by better use of related data that is already being collected, but has not yet been linked to the existing hydrologic data. Examples are meteorological data from inside and near the Preserve, and water quality and stage data collected near the Preserve. Incorporating these data is a cost-effective way of enhancing

the Preserve's monitoring program and the programs of other agencies.

Both location and type of land use have a major influence on surface and ground water quality and flow patterns. General land use near the Preserve needs to be monitored as a predictor of potential impacts on the water resources of the Preserve.

The Preserve should support the several other monitoring efforts ongoing in the region which directly or indirectly complement its program. These include the U.S. Geological Survey's South Florida National Water Quality Assessment (NAWQA) Program, the regional mercury contamination assessment, aquifer characterization studies, and evapotranspiration studies.

The following projects address the monitoring component of the Preserve's water resources program:

- Assess the Hydrologic Monitoring Network
- Expand the Existing Hydrologic Monitoring Network
- Incorporate External and Internal Meteorological Information into Hydrological Database
- Incorporate Water Quality Data from External Sources into Hydrological Database
- Incorporate Water Stage Data from External Sources into Hydrological Database
- Inventory Internal Land Use
- Inventory External Land Use
- Support the South Florida National Water Quality Assessment Program
- Support Regional Mercury Contamination Assessment
- Support Aquifer Characterization Studies
- Support Evapotranspiration Monitoring Efforts

Cooperation and Coordination

The purpose of this component of the water resources management program is to:

> *Establish a proactive role for Big Cypress National Preserve in regional water management, in which it can both contribute meaningfully to regional efforts as well as benefit from the results of these efforts.*

Cooperation and coordination is an essential component of the water resources management program, because it is the only way to ensure that the resources of the Preserve are fully considered in regional decisions, which will directly affect those resources. It is also the only way for the Preserve to have an effective water resources management program because it is very unlikely that the Preserve will, or should, ever have the staff and funding necessary for a complete and autonomous program.

Efforts to enhance working relationships with others are also based on a recognition that the water resources of the Preserve are intrinsically linked to the regional hydrology. Public Law 100-301 tacitly acknowledges that Big Cypress National Preserve is more than the originally-designated self-contained hydrologic unit in south Florida. Even with the original boundaries of the Preserve, there was considerable movement of water to and from surrounding lands.

Actions in support of current cooperative efforts with other agencies are of high priority. They represent activities that have developed from proactive policy in the Preserve that has responded to issues of concern both within the Preserve and of regional significance. Examples of mutually-beneficial cooperation are the current efforts of the South Florida Water Management District and U.S. Geological Survey to identify the hydrologic characteristics of the Shallow and Floridan Aquifers that underlay the Preserve. Efforts by the Preserve in support of this activity will help insure that necessary regional coverage of field data can be achieved. Other examples of current cooperation include the South Florida Water Management District's Cooperative Agreement for hydrological data collection and exchange, and the proposed Central and Southern Florida Project, Comprehensive Review Study with the U.S. Army Corps of Engineers and District to address the impacts of the L-28 Levee and Tieback on the fresh water deliveries entering the Preserve and Everglades National Park. All such efforts produce a cost effective approach toward addressing regional water resource impacts that directly affects the Preserve.

Though a cooperative approach to management cuts across most aspects of water resources management in the Preserve, several actions can be identified that specifically relate it. The first five high-priority projects identified in the following list strengthen the hydrologic monitoring program and information exchange related to it. The monitoring program needs to be expanded to a level comparable to similar water resource programs in the region. Expansion of the network necessary for the internal needs of the Preserve also further enhances the regional database.

Another major area where a coordinated effort can be implemented, are the several ongoing or proposed activities

that will be enhanced by support from the Preserve. These include the U.S. Geological Survey's South Florida NAWQA Program, the regional mercury contamination assessment, aquifer characterization studies, and evapotranspiration studies. Support should include assistance with logistics, research and collection permits, compliance, data sharing and collection, and access to remote areas of the Preserve.

The Preserve should establish coordination with the Seminole and Miccosukee Tribes to assure protection of the Preserve's water resources and successful implementation of their respective water management plans.

Coordination will require both action at management levels to continually identify and articulate the Preserve's role and responsibility in water management and action at the technical level to supply data needed for management decisions and to respond to and support such decisions.

The following projects are key areas where coordination with the appropriate agencies can result in mutual benefits:

- Expand the Existing Hydrologic Monitoring Network
- Prepare Annual Water Resources Reports
- Incorporate External and Internal Meteorological Information into Hydrological Database
- Incorporate Water Quality Data from External Sources into Hydrological Database
- Incorporate Water Stage Data from External Sources into Hydrological Database
- Support the South Florida National Water Quality Assessment Program
- Support Regional Mercury Contamination Assessment
- Support Aquifer Characterization Studies
- Support Evapotranspiration Monitoring Efforts

Data Management

The purpose of this component of the water resources management program is to:

> *Establish data management systems for the acquisition, storage, and retrieval of data and information in a timely and readily-accessible format for internal use and for acquisition by other users.*

The Preserve is currently working with the hydrology staff at Everglades National Park to incorporate some of their data management techniques for water stages in order to improve data communication between the two National Park Service units. The Preserve's Geographic Information System can also provide a graphical vehicle to enhance a variety of water-related data.

Consideration should be given to the organization of the database in a format compatible with other hydrologic databases in south Florida. Data from these data banks should be accessed and integrated, as appropriate, into the data bank of the Preserve. As time and staffing permits, ancillary data on land use, flow impediments, and other similar useful parameters should be incorporated into the database in formats useful for hydrologic interpretation.

The following projects address the issues related to the management of hydrologic and associated data for the Preserve:

- Prepare Annual Water Resources Reports
- Incorporate External and Internal Meteorological Information into Hydrological Database
- Inventory Flow Impediments and Water Control Structures
- Improve Topographic Map Resolution
- Inventory Internal Land Use
- Inventory External Land Use

Specific Water Resources Issues

In contrast to a generally programmatic approach to the previous three components, this component is site or issue specific. The purpose is to:

> *Recognize and address the ever-changing specific issues that have altered, or threaten to alter, the natural water resources regime.*

This plan proposes projects, presented in project statements in the next chapter, to address specific issues at levels felt appropriate at this time. These issues and corresponding projects are not intended as all-inclusive; indeed, new issues will arise in the future and some others exist today that simply lack the urgency to warrant inclusion at this time. Additionally, priorities are likely to change over time for those issues that are presented in this plan.

Sixteen projects identify actions required by projects associated with specific water-related issues. High priority actions relate to the L-28 Interceptor and L-28 Levee system. Decisions on the fate of the L-28 systems could seriously affect the hydrology of the entire eastern part of the Preserve. Two other projects pertaining to Loop Road

and the Barron River Canal are also high priorities because they address recognized flow problems.

The Tamiami Trail borrow canal is monitored routinely by the U.S. Geological Survey. These data will be incorporated into the Preserve's hydrologic database. The need for additional hydrological information along Alligator Alley will be assessed in the reevaluation of the hydrological monitoring system.

Most of the other specific projects address monitoring or mitigating impacts of activities in the Preserve such as oil and gas developments, traditional American Indian uses, non-Federal land use, ORV use, and grazing. The relative priorities are based on the known or potential impacts to resources, the current status of knowledge, and manageability of the problem.

Four projects do not fall into either of the above described groups. Of these, the highest priority is to develop a water quality baseline for the Preserve, where it is proposed to develop a statistically-supportable characterization of the existing water quality that can be used as enforcement criteria under the non-degradation standard that applies to the Preserve. This project is essential to the enforcement of water quality standards under the Preserve's current designation as Outstanding Florida Waters. A second project in this group is proposed for the Preserve to seek an Outstanding National Resource Waters designation, giving it the highest level of water quality protection. A third project statement proposes actions to bring the Preserve's water supply and wastewater systems into full compliance. Lastly, a research project seeks to identify indicator biota useful in monitoring the health of the Big Cypress hydrological system. This particular project has a relatively low priority because so many other obvious impacts and information gaps exist with more immediate application to the welfare of the Preserve.

The following project statements address specific water resource issues identifiable at this time:

- Develop a Water Quality Baseline for the Preserve
- Support Efforts to Assess and Mitigate Impacts from L-28 Interceptor and L-28 Levee Systems on Water Resources
- Support Efforts to Assess and Mitigate Impacts from Loop Road on Water Resources
- Support Efforts to Assess and Mitigate Impacts from Barron River Canal on Water Resources
- Evaluate and Pursue Outstanding National Resource Waters Designation for the Preserve
- Monitor Impacts from Oil & Gas Operations on Water Resources
- Monitor Salinity Gradients in Canals and Estuaries
- Identify and Monitor Impacts from Off-Road Vehicle Use on Water Resources
- Identify Wetland Reclamation Projects
- Identify and Monitor Traditional Indian Land Uses
- Identify and Monitor Non-Federal Land Uses
- Identify and Monitor Impacts from Grazing on Water Resources
- Inventory Existing Underground Storage Tanks and Properly Close or Upgrade
- Monitor Remediation of Creosote Contamination in Jerome
- Inventory Compliance Requirements for the Preserve's Water Supply and Wastewater Systems
- Support Efforts to Inventory Indicator Biota

Staff and Support Needs

The purpose of this component of the water resources management program is to:

> *Identify the adequate number and expertise of water resources staff necessary to implement the program proposed in this plan.*

Additional staff and support funding will be required to accomplish the objectives and requirements of this program. Funding for the Preserve is provided in two basic types: permanent, or "base" funding, and temporary, or "project" funding. Many water resources activities must be conducted over sustained periods and require a continuity of knowledge, working relationships, and techniques that can only be accomplished effectively with permanent staff in base-funded positions. Increases in base funding are not common, and there is no well-established process for acquiring additional base funds or personnel. However, because of the predominant role of water in the Preserve, additional funding must be sought whenever opportunities arise.

There are, however, several well-established avenues for seeking project funds. The project statements presented in each of the other program components are developed specifically for this purpose.

Current staffing and a staffing plan to effectively manage this program are shown in Figure 13. The current staff consists of two permanent positions: a Hydrologist who provides program management, data management, and field work support, and a Hydrologic Technician who provides

field work in both water quality and quantity. As stated previously, the current staff is barely adequate to carry out the existing program, let alone implement an expanded program. A workload analysis was conducted in order to determine the workload involved in each component of the desired program and the type and level of expertise required. In addition to staff experience, the National Park Service Resources Management Assessment Program (R-MAP) and a comparison to programs in natural areas of similar size and complexity were used to develop the staffing plan.

The desired organization and structure adds four permanent positions and one seasonal position. When fully implemented, the program staff will be divided among four primary functions: program management, water quantity, water quality, and data management. Water quantity and water quality functions are the most heavily staffed with three and two full-time positions respectively, because of the amount of field work involved. New positions will be added incrementally. With the assumption that the existing Hydrologist position will expand to a more supervisory role, and the Hydrologic Technician will be focused more on data management, the order of priority for additional positions is:

1. Hydrologist (Water Quantity)
2. Hydrologist (Water Quality)
3. Data Management Technician
4. Hydrologic Technician (Water Quality)
5. Hydrologic Tech. (Seasonal)(Water Quantity)

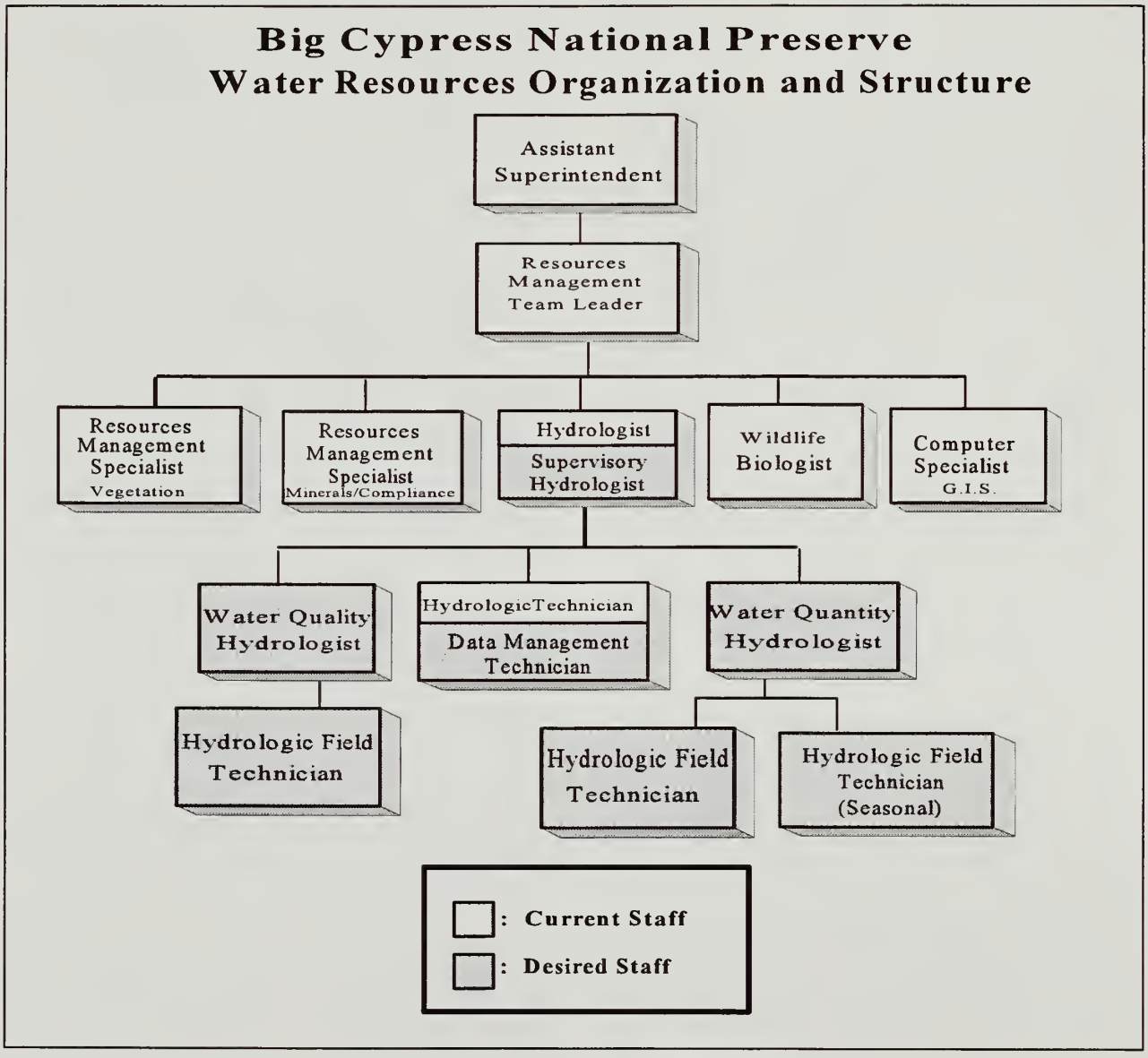


Figure 13. Organization Structure for Proposed Water Resources Management Program at Big Cypress National Preserve.

Until the full organization is complete, staff will have multiple roles. However, the full organization should be considered as each position is filled. For example, the first position filled should have the background and ability to lead a water quantity program, even though some of the immediate workload will involve data management and water quality.

The total program represents an ambitious effort to establish a firm, hydrologically-sound basis for competent, rational management of the water resources of the Preserve through detailed understanding of its hydrology, knowledge of major influences on it, and a strong database to support decision-making.

Implementation of this program will require long-term, continuous commitments of personnel and funding. It is, however, essential in providing a level of data and hydrologic information needed by the Preserve for effective and wise management of its water resources, not only for its own benefit but also for the benefit of the total ecosystem of which it is a part.

The program is extensive. It will require time and commitment. It is also vital to the protection of the major resource of the Preserve -- its water.

PROJECT STATEMENTS

The thirty specific projects cited in the Water Resources Management Plan are listed below in order of current priority and are summarized in the following table (see Table 2). These priorities, however, are likely to change as tasks are completed, more is learned about the hydrology of the system, and decisions are made internally and externally affecting the relative urgency of various issues.

The projects are also listed in greater detail in Appendix A in the standard format of the National Park Service programming documents. It should be noted that each project budget, included in Appendix A, represents estimated costs associated with equipment, supplies and/or contract work needed for the respective projects. The full-time equivalent (FTE) costs are not included in these project budgets, but the estimated FTE requirements (i.e., 0.5 FTE/year) and specific grades (i.e., GS-9) are defined for each project statement in Appendix A. These documents are both planning tools used to identify problems and needed actions, and standardized programming documents used within the National Park Service to compete with other park projects for funds and staff.

BICY-N-001 Assess the Hydrologic Monitoring Network
BICY-N-033 Expand the Existing Hydrologic Monitoring Network
BICY-N-034 Prepare Annual Water Resources Reports
BICY-N-074 Develop a Water Quality Baseline for the Preserve
BICY-N-097 Incorporate External and Internal Meteorological Information into Hydrological Database
BICY-N-098 Inventory Flow Impediments and Water Control Structures
BICY-N-099 Improve Topographic Map Resolution
BICY-N-100 Incorporate Water Quality Data from External Sources into Hydrological Database
BICY-N-103 Incorporate Water Stage Data from External Sources into Hydrological Database
BICY-N-104 Inventory Internal Land Use
BICY-N-106 Inventory External Land Use
BICY-N-200 Support the South Florida National Water Quality Assessment Program
BICY-N-201 Support Regional Mercury Contamination Assessment
BICY-N-202 Support Aquifer Characterization Studies
BICY-N-203 Support Evapotranspiration Monitoring Efforts
BICY-N-204 Support Efforts to Assess and Mitigate Impacts from L-28 Interceptor and L-28 Levee Systems on Water Resources
BICY-N-205 Support Efforts to Assess and Mitigate Impacts from Loop Road on Water Resources
BICY-N-206 Support Efforts to Assess and Mitigate Impacts from Barron River Canal on Water Resources
BICY-N-207 Evaluate and Pursue Outstanding National Resource Waters Designation for the Preserve
BICY-N-208 Monitor Impacts of Oil & Gas Operations on Water Resources
BICY-N-209 Monitor Salinity Gradients in Canals and Estuaries
BICY-N-210 Identify Wetland Reclamation Projects
BICY-N-211 Identify and Monitor Impacts from Off-Road Vehicle Use
BICY- I -212 Identify and Monitor Traditional Indian Land Uses
BICY- I -213 Identify and Monitor Non-Federal Land Uses
BICY-N-214 Identify and Monitor Impacts from Grazing on Water Resources
BICY- I -215 Inventory Existing Underground Storage Tanks and Properly Close or Upgrade
BICY-N-216 Monitor Remediation of Creosote Contamination in Jerome
BICY- I -217 Inventory Compliance Requirements for the Preserve's Water Supply and Wastewater Systems
BICY-N-218 Support Efforts to Inventory Indicator Biota

TABLE 2
Summary of Project Statements

PROJECT #	PROJECT NAME	ISSUES ADDRESSED	PROBLEM SUMMARY	SUMMARY OF PROPOSED ACTIONS
BICY-N-001	**Assess the Hydrologic Monitoring Network**	Long-Term Hydrologic Monitoring	The increase in external influences (i.e., nutrient enrichment, modified water deliveries, etc.) on the Preserve's watersheds, the continuous internal influences from recreational and traditional land use, and the BICY expansion warrants an assessment of the Preserve's existing hydrological monitoring network.	1. Utilize the GIS and other land use maps and data to define areas where the potential for impacts to the Preserve's water resources exist. 2. Identify the appropriate water quality parameters (i.e., nitrates, phosphates, bacteria, mercury, etc.) associated with the various land use practices. 3. Evaluate the Preserve's existing water quality and water stage data and identify anomalies and/or trends, if present. 4. Identify potential routes of influence (i.e., strands, canals, etc.) based on location of water quality/water stage threats. 5. Incorporate information collected from #1, #2, #3, & #4 into a summary report which will prioritize locations for additional monitoring stations, incorporate a ground water component and, if necessary, identify additional parameters needed for adequate evaluation of the water quality

TABLE 2 (continued)
Summary of Project Statements

PROJECT #	PROJECT NAME	ISSUES ADDRESSED	PROBLEM SUMMARY	SUMMARY OF PROPOSED ACTIONS
BICY-N-033	**Expand the Existing Hydrologic Monitoring Network.**	Long-Term Hydrologic Monitoring Coordination	BICY will need to expand the existing hydrologic monitoring network, including water quality parameters, to adequately address boundary expansion and changes in external/internal land uses.	1. Implement the recommendations proposed in Project Statement BICY-N-001 (Assess Hydrologic Monitoring Network). 2. Initiate cooperative efforts with various external agencies (i.e., SFWMD, USGS, COE) for support to expand the existing monitoring network. The South Florida Water Management District currently provides the Preserve with all the necessary equipment upgrades for the existing monitoring network, including the laboratory analyses for specific water quality parameters. 3. Establish a base-funded position (GS-7) for the necessary personnel to meet the increased demands for continuous data collection and station maintenance. 4. Install additional surface water and ground water quality monitoring stations which include automated water stage recorders. Also include additional meteorological monitoring equipment at appropriate stations, as necessary. 5. Survey all new monitoring stations to a common datum and input into BICY's GIS. 6. Upon completion of expanding the Preserve's monitoring network (2-3 years) with the financial support from external agencies, a base increase for two FTE's (GS-9/11) will be necessary to assist the existing staff with operation of the expanded network.

TABLE 2 (continued)
Summary of Project Statements

PROJECT #	PROJECT NAME	ISSUES ADDRESSED	PROBLEM SUMMARY	SUMMARY OF PROPOSED ACTIONS
BICY-N-034	**Prepare Annual Water Resources Reports**	Coordination Data Management	BICY has collected water stage and water quality data since 1988 without an adequate assessment of the hydrological information since 1989. Hydrologic summary reports are required by BICY to meet their contractual agreement with SFWMD and to make informed decisions by NPS management. The mutual sharing of hydrologic information between other agencies (i.e., SFWMD, EPA, USGS, COE) is critical for the development of regional hydrologic assessments in south Florida.	1. Incorporate appropriate data management software to provide summaries (i.e., graphs, tables) of various hydrologic data. 2. Prepare comparisons of historical and current hydrologic data. 3. Prepare appropriate GIS maps for depicting isopleths for water stage and concentrations for specific water quality parameters. 4. Prepare narrative which summarizes any trends or anomalies in the hydrologic data. 5. Submit water resources report to appropriate agencies (i.e., SFWMD, USGS, EVER, WRD, COE).

TABLE 2 (continued)
Summary of Project Statements

PROJECT #	PROJECT NAME	ISSUES ADDRESSED	PROBLEM SUMMARY	SUMMARY OF PROPOSED ACTIONS
BICY-N-074	**Develop a Water Quality Baseline for the Preserve**	Baseline Information Specific Internal Water Resources Issue	The development of a numeric baseline of water quality conditions is necessary to implement the non-degradation water quality standards which apply to the Preserve. The waters of BICY are currently designated as Outstanding Florida Waters. This is a designation under the Clean Water Act, intended to afford the highest level of protection to existing high quality waters.	1. Assemble data available in the Preserve and from external sources. 2. Conduct preliminary analyses on the Preserve's historical water quality data to determine if the database appears to be sufficient to characterize the ambient water quality conditions, during the designated baseline period, for specific areas of the Preserve. This must include key parameters, and represent natural spacial and seasonal variability. 3. Where the database is inadequate for the baseline year, identify an alternative period that, based on continuity of land and water use patterns and the available data record, is representative of ambient water quality during the baseline year. 4. Coordinate with the Florida Department of Environmental Protection to get their concurrence on the statistical methodology to be used, and, if necessary, to identify alternative data periods that represent the baseline periods. An adequate statistical analysis may require several years of data, which will necessitate concurrence that this data record is representative of the designated baseline period. 5. Employ appropriate statistical techniques to derive confidence interval estimates for the 0.85, 0.90 and 0.95 level quantities from the selected parameters defined in #1. A confidence level of 0.95 or greater should be used, if possible. 6. Present the results to the Florida Department of Environmental Protection for adoption as representative of baseline water quality conditions to be protected from degradation under Florida laws and regulations.

TABLE 2 (continued)
Summary of Project Statements

PROJECT #	PROJECT NAME	ISSUES ADDRESSED	PROBLEM SUMMARY	SUMMARY OF PROPOSED ACTIONS
BICY-N-097	**Incorporate External and Internal Meteorological (MET) Information into Hydrological Database**	Long-Term Hydrologic Monitoring Coordination Data Management	Need for cooperative efforts between BICY's Hydrology Program and internal (BICY Fire Program) and various external (i.e., NOAA, SFWMD, EVER) sources to obtain MET information relevant to BICY's water resources. This data would expand BICY's existing MET monitoring network. The variability of precipitation events within the Preserve warrants a more comprehensive MET monitoring network.	1. Obtain existing (historical) MET data from various external sources (i.e., NOAA, SFWMD, EVER, etc.). The MET data should not be restricted to the Preserve boundaries but include the entire watersheds of the Preserve. 2. Prepare the MET data (historical) into a compatible database format for the hydrology program. 3. Input all appropriate MET locations into BICY's GIS database. 4. Develop and implement procedures for the electronic transfer of future MET data from appropriate external sources and the Preserve's Fire Division.
BICY-N-098	**Inventory Flow Impediments and Water Control Structures**	Baseline Information Data Management	BICY does not have a complete and accurate inventory of surface water flow impediments and water control structures. This information will assist with future hydrologic model applications and surface water drainage definition.	1. Survey locations and elevations for all man-made structures (i.e., roads, canals, bridges, culverts, weirs, earthen plugs) which influence the natural hydrologic conditions within the Preserve. 2. Conduct a detailed inventory for each structure which includes; size and general condition. 3. Import survey data into the BICY's GIS. 4. Develop a computer inventory database for storing the specific information (size, etc.) collected on each structure. 5. Conduct a survey of structures in the Preserve every five years and update the GIS database, as necessary. 6. Prepare a qualitative and/or quantitative assessment of the relative impact to surface and ground water flows caused by each structure.

TABLE 2 (continued)
Summary of Project Statements

PROJECT #	PROJECT NAME	ISSUES ADDRESSED	PROBLEM SUMMARY	SUMMARY OF PROPOSED ACTIONS
BICY-N-099	**Improve Topographic Map Resolution**	Baseline Information Data Management	Surface flows within the BICY's boundaries are not well defined. Accurate topographic data of the Preserve is needed to better understand the duration of inundation and surface water flows. BICY's topography is a primary factor influencing the surface water flow patterns.	1. Obtain USGS 1995-96 topographic survey data of the Preserve. 2. Contact USGS to conduct topographic survey of areas not included in 1995-96 survey. 3. Digitize topographical data and import into BICY's GIS.
BICY-N-100	**Incorporate Water Quality Data from External Sources into Hydrological Database**	Long-Term Hydrologic Monitoring Coordination	Need for cooperative efforts between BICY and various external sources (i.e., SFWMD, USGS, COE) to obtain available water quality information relevant to BICY's water resources. This data would expand BICY's existing monitoring network.	1. Acquire existing water quality data from external sources (i.e., SFWMD, USGS). 2. Identify appropriate water quality data for BICY's water quality database. 3. Prepare external water quality data (historical) into compatible database format. 4. Develop and implement procedures for the exchange of water quality data from the various external sources on a scheduled frequency. 5. Incorporate water quality data collected from external sources into BICY's water quality database.
BICY-N-103	**Incorporate Water Stage Data from External Sources into Hydrological Database**	Long-Term Hydrologic Monitoring Coordination	Need for cooperative efforts between BICY and various external sources (i.e., SFWMD, USGS, COE) to obtain all available water stage information relevant to BICY's water resources. This data would expand BICY's existing monitoring network.	1. Acquire existing water stage data from external sources (i.e., SFWMD, USGS, COE). 2. Identify appropriate water stage data for BICY's water stage database. 3. Prepare external water stage data (historical) into compatible database format. 4. Develop procedures and implement for the exchange of water stage data from the various external sources on a scheduled frequency. 5. Incorporate water stage data collected from external sources into BICY's water stage database.

TABLE 2 (continued)
Summary of Project Statements

PROJECT #	PROJECT NAME	ISSUES ADDRESSED	PROBLEM SUMMARY	SUMMARY OF PROPOSED ACTIONS
BICY-N-104	**Inventory Internal Land Use**	Baseline Information Long-Term Land Use Monitoring	A comprehensive inventory of all current and past land uses in BICY (i.e., grazing, minerals development, etc.) and their respective areas of influence has not been conducted. As a result, impacts to BICY's water resources from these internal land uses is not fully understood.	1. Inventory and define the boundaries of influence for the various land uses in the Preserve and incorporate (digitize areas of influence) into the GIS database. 2. Prepare a report summarizing the status of internal land uses, trends, potential threats and documented impacts to BICY's water resources.
BICY-N-106	**Inventory External Land Use**	Baseline Information Long-Term Land Use Monitoring	The various land uses (i.e., agriculture, American Indian land use, etc.) immediately outside the Preserve's boundary are not adequately defined or monitored. These land uses have the potential to affect the quality and quantity of waters entering the Preserve through Kissimmee Billy Strand, Mullet Slough, Okaloacoochee Slough, Barron River Canal and L-28 Interceptor Canal systems.	1. Inventory and define the boundaries of influence for the various external land uses within BICY's watersheds and incorporate (digitize areas of influence) into the GIS database. 2. Prepare a report summarizing the status of external land uses, trends, potential threats and documented impacts to BICY's water resources.
BICY-N-200	**Support the South Florida National Water Quality Assessment Program**	Long-Term Hydrologic Monitoring Coordination	The Preserve is not been actively involved with the National Water Quality Assessment Program. The Southern Florida NAWQA study began in 1993 and water quality data from BICY is needed to compliment this important program.	1. Assist the USGS with field activities (i.e., identifying BICY's existing water quality monitoring network and locating other potential field sampling sites) in the Preserve that will provide the initial planning direction for the Big Cypress Swamp and Everglades physiographic regions. 2. Participate in program planning decisions by attending the South Florida NAWQA liaison committee meetings which meet twice a year. 4. Submit the Preserve's monthly water quality data to the USGS. 5. Incorporate appropriate NAWQA data into the Preserve's hydrology database.

TABLE 2 (continued)
Summary of Project Statements

PROJECT #	PROJECT NAME	ISSUES ADDRESSED	PROBLEM SUMMARY	SUMMARY OF PROPOSED ACTIONS
BICY-N-201	**Support Regional Mercury Contamination Assessment**	Long-Term Hydrologic Monitoring Coordination	EPA , USGS and USFW have been actively working on mercury assessment projects throughout the BICY and EVER region. BICY's involvement has been very limited.	1. Review existing and ongoing efforts by EPA, USFWS & USGS to assess mercury contamination. 2. Develop cooperative professional relationships with active agencies. 3. Provide support, as necessary, to compliment ongoing efforts.
BICY-N-202	**Support Aquifer Characterization Studies**	Long-Term Hydrologic Monitoring Coordination	BICY does not have hydro geologic data which defines the characteristics of the shallow and deep aquifers in the area.	1. Support efforts conducted by SFWMD to assess the Floridan Aquifer system. 2. Support efforts by the USGS to study the Shallow and Biscayne Aquifer systems. 3. Obtain existing (historical) hydro geologic data from various external sources. The data should not be restricted to the Preserve's boundaries, but include the entire watersheds of the Preserve. 4. Prepare appropriate hydro geologic data (i.e., transmissivity, storativity, water quality, etc.) into a compatible database format for BICY's hydrology program.
BICY-N-203	**Support Evapotranspiration Monitoring Efforts**	Long-Term Hydrologic Monitoring Coordination	BICY does not collect evapotranspiration (ET) data in the Preserve for water budget analyses.	1. Assist USGS efforts to establish ET monitoring stations in the Preserve and to collect data. 2. Develop procedures for the exchange of ET data from the USGS, SFWMD and other appropriate agencies. 3. Incorporate ET data into BICY's hydrologic database.

TABLE 2 (continued)
Summary of Project Statements

PROJECT #	PROJECT NAME	ISSUES ADDRESSED	PROBLEM SUMMARY	SUMMARY OF PROPOSED ACTIONS
BICY-N-204	**Support Efforts to Assess and Mitigate Impacts from L-28 Interceptor and L-28 Levee Systems on Water Resources**	Specific Internal Water Resources Issue	The L-28 Interceptor and L-28 Levee systems interrupt the natural drainage along BICY's northeastern and eastern boundary.	1. Support ongoing efforts by the COE and SFWMD to mitigate impacts of L-28 system on BICY's water resources. 2. Support efforts to monitor hydrological impacts from the L-28 Interceptor system. 3. Review water quality data from Water Conservation Area 3A and evaluate problems, if any, associated with an increase in water deliveries from the Water Conservation Area to BICY through the L-28 Levee. 4. Before and after the completion of appropriate modifications to the L-28 levee and canal, monitor the water quality and quantity within the area of influence. 5. Monitor water deliveries from the Seminole's Big Cypress Reservation along BICY's northern boundary.
BICY-N-205	**Support Efforts to Assess and Mitigate Impacts from Loop Road on Water Resources**	Specific Internal Water Resources Issue	The existing bridges and culverts along Loop Road are inadequate for transmitting surface water southward across the roadway. Flooding is common along Loop Road due to inadequate drainage of the natural flow regimen.	1. Inventory (i.e., location, size) the existing culverts and bridges located along Loop Road and input into BICY's GIS. 2. Work with the appropriate county (Monroe, Dade, Collier) to have damaged culverts repaired or replaced. 3. Evaluate the following data to determine locations for additional culverts along Loop Road: ■ existing bridge and culvert locations ■ locations of seasonal flooding of Loop Road ■ GIS vegetation map for the Loop Road area. 4. Monitor the effectiveness of the culverting project (i.e., define areas which continue to flood, if any) during the wet season. 5. Prepare proposal for a Phase II culverting project to address any continuous inundation problems. 9. Prepare progress summaries of project.

TABLE 2 (continued)
Summary of Project Statements

PROJECT #	PROJECT NAME	ISSUES ADDRESSED	PROBLEM SUMMARY	SUMMARY OF PROPOSED ACTIONS
BICY-N-206	**Support Efforts to Assess and Mitigate Impacts from Barron River Canal on Water Resources**	Specific Internal Water Resources Issue	The Barron River Canal currently has eight stop-log weirs that are in poor condition and no control structures to allow natural flow under SR-29 into Fakahatchee Strand. This canal system drains agriculturally active areas to the north and contains some of the highest recorded pesticide concentrations in Florida.	1. Support efforts conducted by FDOT and SFWMD to install additional water control structures from the Barron River Canal through SR 29 and into Fakahatchee Strand. 2. Inventory (i.e., location and size) all new and existing water control structures and input into BICY's GIS. 3. Establish a permanent water quality station in the canal along the northern border of the Preserve and incorporate into the Preserve's existing monitoring network. 4. Develop a proposal to address the water and/or sediment quality problems associated with the Barron River Canal system.
BICY-N-207	**Evaluate and Pursue Outstanding National Resource Waters Designation for the Preserve**	Specific Internal Water Resources Issue	Upgrading BICY's Outstanding Florida Waters designation to Outstanding National Resource Waters, the most stringent designation available under the Clean Water Act and Florida Statutes, would provide an additional level of protection for BICY's threatened waters.	1. Preparation of a request for redesignation, and submission to the FDEP. This is a relatively straight forward procedure, as presented in Section 120.54 of the Florida Statutes. 2. Participate in a series of state-conducted workshops to seek input on the proposal. 3. Provide support to the state in their analysis of benefits and costs of an ONRW designation. 4. Coordinate with, and where necessary provide testimony to, the state legislature or individual legislators.
BICY-N-208	**Monitor Impacts of Oil & Gas Operations on Water Resources**	Specific Internal Water Resources Issue	Active oil & gas operations in BICY pose a threat to its water resources. The procedures for monitoring water quality during oil & gas operations in the Preserve are general (as defined in Stipulation 20 of the MMP) and do not address site specific issues.	1. Review proposed water quality monitoring plans prior to future oil & gas drilling or production. 2. Once an approved monitoring plan is implemented, BICY should develop internal audit procedures and database management systems to evaluate water quality monitoring programs for active oil & gas operations.

TABLE 2 (continued)
Summary of Project Statements

PROJECT #	PROJECT NAME	ISSUES ADDRESSED	PROBLEM SUMMARY	SUMMARY OF PROPOSED ACTIONS
BICY-N-209	**Monitor Salinity Gradients in Canals and Estuaries**	Specific External Water Resources Issue	There is currently no available data to assess the relationship of fresh water flows from the Preserve to the estuarine environment of EVER. It is important for BICY to support EVER's efforts to better evaluate changes in salinity gradients within BICY's borrow canals which flow into the estuarine environment.	1. Identify the areas along canal systems where changes in vegetative communities, water conductivity, chloride and/or sodium have been documented. 2. Monitor these areas for specific water quality parameters (i.e., conductivity, chloride, sodium) and surface water discharge to evaluate seasonal concentration ranges of the indicator parameter(s) and flow. 3. Evaluate data and compare with background water quality data. Identify unnatural anomalies or trends in salinity gradients. Incorporate plant and/or animal indicator species, if present, into the supporting evidence of variation in salinity gradients. 4. Develop mitigation alternatives to correct any anomalous salinity gradients identified during the project.
BICY-N-210	**Identify Wetland Reclamation Projects**	Specific Internal Water Resources Issue	Need for a comprehensive list of prioritized wetland restoration projects in BICY that could be undertaken by external entities that are required to restore wetlands as an offset to wetlands they propose to impact.	1. Prepare a prioritized list of wetland reclamation projects (including impacted acreage and anticipated scope of work). 2. Contact the COE 404 Offices and the FDEP and advise them that BICY has identified disturbed wetlands that are available for restoration. 3. Annually amend the list of wetland reclamation projects, as necessary. 4. Conduct appropriate monitoring of each wetland reclamation project to better ensure the effectiveness of the restoration project. 5. Prepare a summary report for each reclamation project.

TABLE 2 (continued)
Summary of Project Statements

PROJECT #	PROJECT NAME	ISSUES ADDRESSED	PROBLEM SUMMARY	SUMMARY OF PROPOSED ACTIONS
BICY-N-211	**Identify and Monitor Impacts from Off-Road Vehicle Use on Water Resources**	Specific Internal Water Resources Issue	BICY does not have a comprehensive inventory of the areas of influence from ORV use or a good understanding of the associated impacts to the water resources.	1. Identify locations subject to high ORV use in BICY and identify areas of influence utilizing the GIS. 2. Input ORV use information into the GIS. 3. Identify and prioritize the areas of influence from ORV use which potentially impact the water resources in BICY. 4. Conduct site specific studies to assess the water quality and quantity impacts on the local water resources. These site-specific studies would primarily focus on the following: a. topographical alterations - survey topographic elevations of the "area of influence". b. surface water flow and/or velocity alterations - in most cases dye tracing would be employed to effectively determine flow direction and velocity due to the typically low water velocity of sheet flow. c. water quality alterations - primarily turbidity. d. vegetation alterations - this would involve assistance from a qualified professional (i.e., botanist). 5. Provide recommendations for water resources protection, as necessary, based on results of each study.

TABLE 2 (continued)
Summary of Project Statements

PROJECT #	PROJECT NAME	ISSUES ADDRESSED	PROBLEM SUMMARY	SUMMARY OF PROPOSED ACTIONS
BICY-I-212	**Identify and Monitor Traditional Indian Land Uses**	Specific Internal Water Resources Issue	A comprehensive inventory of American Indian traditional use sites and an assessment of impacts at those sites is needed, along with follow-up work to correct any problems and mitigate impacts that are identified.	1. Identify the locations of all Indian occupancy and land uses within BICY's boundary, through the use of aerial photographs, contacts with tribal members, and site visits. 2. Input the Indian occupancy and land use boundaries into BICY's GIS. 3. Prioritize study areas based on site specific conditions (i.e., area of influence, resources sensitivity, etc.). Areas with the greatest potential to impact the water resources will be studied first. 4. Each study will include a water quality and/or water quantity assessment. Specific water quality parameters will be defined based on the site specific conditions observed within the area. 5. Individual studies will expand, as necessary, to fully assess impacts to the surrounding environment. 6. Summary reports will be prepared which identify any hydrological impacts and include any necessary recommendations. 7. As results become available, BICY will work with the tribes and state of Florida to correct and mitigate the problems that are identified.

TABLE 2 (continued)
Summary of Project Statements

PROJECT #	PROJECT NAME	ISSUES ADDRESSED	PROBLEM SUMMARY	SUMMARY OF PROPOSED ACTIONS
BICY-I-213	**Identify and Monitor Non-Federal Land Uses**	Specific Internal Water Resources Issue	Impacts from non-Federal land uses on BICY's water resources are unknown. BICY does not have a comprehensive inventory of specific in-holding land uses and respective locations.	1. Input all non-Federal land boundaries into BICY's GIS. 2. Prioritize study areas based on site specific conditions (i.e., resources sensitivity, etc.). Areas with the greatest potential to impact the water resources will be studied first. 3. Each study will include a water quality and/or water quantity assessment. Specific water quality parameters will be defined based on the site specific conditions observed within the area. 4. Individual studies will expand, as necessary, to fully assess impacts to the surrounding environment. 5. Summary reports will be prepared which identify any hydrological impacts and include any necessary recommendations. 6. As results become available, the Preserve will work with landowners and appropriate regulatory agencies to correct and mitigate problems that are identified.

TABLE 2 (continued)
Summary of Project Statements

PROJECT #	PROJECT NAME	ISSUES ADDRESSED	PROBLEM SUMMARY	SUMMARY OF PROPOSED ACTIONS
BICY-N-214	**Identify and Monitor Impacts from Grazing on Water Resources**	Specific Internal Water Resources Issue	The impacts from cattle grazing on local water resources in BICY are unknown. Nutrient and/or bacteria contamination of the water resources are commonly associated in areas with high concentrations of cattle.	1. Identify all leased grazing areas within BICY and input these boundaries into BICY's GIS. 2. Prioritize initial study areas based on site specific conditions. Areas with the greatest potential to impact the water resources will be studied first. 3. Each initial study will include analysis of water samples for bacteria (fecal coliform), turbidity, dissolved oxygen, pH, ammonia, water temperature and nutrients (nitrates & phosphates). Initial studies will consist of two or three sampling events to provide a preliminary assessment of water quality impacts, if any. 4. These short-term studies will expand, as necessary, to fully assess impacts to the surrounding environment. 5. Summary reports will be prepared which identify water quality impacts and recommendations.
BICY-I-215	**Inventory Existing Underground Storage Tanks and Properly Close or Upgrade**	Specific Internal Water Resources Issue	BICY does not have a comprehensive inventory of existing USTs within its boundaries. There are USTs in BICY which have not been properly closed or upgraded by the responsible parties.	1. Identify the locations of all existing USTs in BICY. 2. Input the UST locations into BICY's GIS. 3. Review state and NPS registration documents and identify all compliance and non-compliance USTs. 4. Register and upgrade all NPS USTs, as necessary. 5. Contract consultant for UST closures or upgrades, as necessary, for all NPS or abandoned USTs. 6. Seek regulatory enforcement for proper closure or upgrades of all non-Federal USTs located in BICY by the respective responsible parties, if necessary. 7. Review documentation (i.e., analytical reports) for required remedial activities conducted at contaminated sites.

TABLE 2 (continued)
Summary of Project Statements

PROJECT #	PROJECT NAME	ISSUES ADDRESSED	PROBLEM SUMMARY	SUMMARY OF PROPOSED ACTIONS
BICY-N-216	**Monitor Remediation of Creosote Contamination in Jerome**	Specific Internal Water Resources Issue	A monitoring program is needed to track the remediation of creosote contamination at a site located in Jerome, Florida, along BICY's western boundary.	1. Review all analytical results and summary reports submitted by CDC regarding the remedial project work at the Jones Mill site. 2. Upon completion of the remediation, obtain the approval letter from the FDEP stating that the ground water and soils at the site and surrounding area(s) meet the FDEP's and EPA's criteria for a clean site and that no further remedial efforts are necessary. 3. Prepare an internal summary report regarding the history of the site, which includes the chronological sequence of events which led to the approved FDEP clean-up.
BICY-I-217	**Inventory Compliance Requirements for the Preserve's Water Supply and Wastewater Systems**	Specific Internal Water Resources Issue	BICY's water supply and wastewater systems need to be maintained in compliance with state standards, and those that are not in compliance need to be improved to acceptable standards.	1. Identify and correct any "non-compliance" operations for water supply and/or wastewater treatment systems. 2. Investigate any new technology for alternative treatment methods.
BICY-N-218	**Support Efforts to Inventory Indicator Biota**	Specific Internal Water Resources Issue	BICY does not typically use indicator biota as a tool to assess water quality or quantity assessments. BICY does not have a coordinated program to identify indicator biota for assisting with hydrological impact assessments.	1. Support internal and/or external efforts to identify and inventory potential indicator biota in south Florida. The following statistical correlations should be developed: a. specific water quality vs specific indicator biota. b. water stage vs specific indicator biota. c. seasonal variation associated with specific indicator biota.

TABLE 2 (continued)
Summary of Project Statements

Acronyms used in Table 2:

BICY	Big Cypress National Preserve
CDC	Collier Development Corporation
CFR	Code of Federal Regulations
COE	U.S. Army Corps of Engineers
EPA	U.S. Environmental Protection Agency
ET	Evapotranspiration
EVER	Everglades National Park
FDEP	Florida Department of Environmental Protection
FDOT	Florida Department of Transportation
GIS	Geographic Information System
GMP	General Management Plan
MMP	Minerals Management Plan
NAWQA	National Water Quality Assessment Program
NOAA	National Oceanic and Atmospheric Administration
NPS	National Park Service
ONRW	Outstanding National Resource Waters
ORV	Off-Road Vehicles
SFWMD	South Florida Water Management District
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
UST	Underground Storage Tanks
WRD	National Park Service Water Resources Division

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APPENDICES

APPENDIX A
PROJECT STATEMENTS

Title: ASSESS THE HYDROLOGIC MONITORING NETWORK

Funding Status: Funded: 0.0 Unfunded: 30.0

Servicewide Issues : N11 (WATER QUAL-EXT)
N20 (BASELINE DATA)
Cultural Resource Type : N/A
RMAP Program codes : Q01

Problem Statement

The increase in external influences (i.e., nutrient enrichment, modified water deliveries) on the Preserve's watersheds, the continuous internal influences from recreational and traditional land use and the Preserve's boundary expansion, warrants an assessment of the Preserve's existing hydrological monitoring network. An effective monitoring network is necessary to detect anomalies in water quality and/or flow in the Preserve, and to better understand the natural hydrologic patterns of the Preserve.

It will be important to modify the monitoring network, as necessary, to anticipate and respond to influences of the dynamic external and internal land use practices on the Preserve's water resources. One of the primary external threats to the quality of waters within the Preserve's watershed is the expansion of agriculture along the northern boundary of the Preserve. Between 1980 and 1990, citrus acreage doubled to 150,000 acres (Mazzotti, et al., 1992) and is projected to reach 200,000 acres by the year 2000. Flow patterns in several areas of the Preserve are influenced by a number of canals, levees and roads. The monitoring program is needed to determine the impacts of these features, and to evaluate the success or failure of several ongoing efforts to remove these structures or mitigate their impacts.

The 729,000 acre Preserve is a unique water-dependent ecosystem. As much as 90 percent of the Preserve is inundated to depths ranging from a few inches to more than three feet during the wet season (May-October). During the dry season (November-April), water levels recede, reducing the areas inundated to approximately 10 percent. The ecology of the Preserve is finely tuned to the seasonal flow of unpolluted water and any interference can alter this sensitive habitat. A typical monitoring network with stations at intervals along a stream is not practical in the Big Cypress Swamp because of the characteristics of widespread sheetflow. As a result, it will be important to evaluate the effectiveness of the hydrological monitoring network to ensure that the water resources are being adequately assessed.

The hydrological monitoring network has expanded from 11 stations in 1988 to a current monitoring network of 14 stations. The expansion of the Preserve by approximately 20 percent has supported the need to expand the existing monitoring network. One of the primary purposes for the establishment of the Preserve was to protect the waters which drain from the Big Cypress Swamp watershed and into Everglades National Park. A complete monitoring network is essential for accomplishing this objective.

Hydrological data collected in the Preserve is important to the needs of the South Florida Water Management District, U.S. Army Corps of Engineers, U.S. Geological Survey, Everglades National Park and other county, state and Federal agencies for providing a better understanding of the hydrology in south Florida. As a result of this importance, strong support and the potential for financial assistance exists for the Preserve's hydrological monitoring network. In 1995, the Preserve executed a five year Cooperative Agreement with the District for maintaining the existing water quality and water stage monitoring program. Under this Agreement, the Preserve collects water stage data and water quality samples monthly following a strict Quality Assurance Project Plan approved by the District. The District performs the laboratory analyses on specific water quality parameters for the Preserve. All hydrological data are made available on the District's DBHYDRO database and water

quality database for external uses by other agencies. Copies of the hydrological information are provided to the Preserve for its internal database management needs. The District has also upgraded all 12 of the Leupold & Stevens Type A71 water stage chart recorders with Campbell CR10 data loggers. This upgrade in 1995 has increased efficiency for the retrieval of water stage data, which will eventually be further upgraded to a radio telemetering system.

Description of Recommended Project or Activity

The objectives of this project are to:

- identify areas where the water resources are not adequately assessed.
- identify appropriate water quality parameters, based on the potential threats, for proper evaluation of the water resources.
- incorporate a ground water monitoring component into the existing monitoring network.

The project will include these elements:

1. Utilizing the Geographic Information System and other land use maps and data, define areas where the potential for impacts to the Preserve's water resources exists.

2. Identify the appropriate water quality parameters (i.e., phosphate, nitrate, bacteria, mercury, etc.) associated with the various land use practices.

3. Evaluate the Preserve's existing water quality and water stage data and identify anomalies and/or trends, if present.

4. Identify potential routes of influence (i.e., strands, canals), based on location of water quality/water stage threats.

5. Incorporate information collected from #1, #2, #3, & #4 into a summary report which will prioritize locations for additional monitoring stations, incorporate a ground water monitoring component and, if necessary, identify additional parameters needed for adequate evaluation of the water quality.

Literature Cited

Mazzotti, F.J., L.A. Brandt, and Others, 1992. An Evaluation of the Regional Effects of New Citrus Development on the Ecological Integrity on Wildlife Resources in Southwest Florida: Final Report, South Florida Water Management District, West Palm Beach, Florida. 187 pp.

BUDGET AND FTEs:

----------FUNDED----------

	Source	Activity	Budget ($1000's)	FTEs
1995:				
1996:	PKBASE-NR	RES		0.3
1997:	PKBASE-NR	RES		0.3
1998:	PKBASE-NR	RES		0.3
	Total:		0.0	0.9

----------UNFUNDED----------

	Source	Activity	Budget ($1000's)	FTEs
1995:				
1996:	ST-LOCAL	RES	10.0	0.1
1997:	ST-LOCAL	RES	10.0	0.1
1998:	ST-LOCAL	RES	10.0	0.1
		Total:	30.0	0.3

Compliance codes: EXCL
Explanation: 516 DM2 App. 1.6
End of data

BICY-N-033.000
Priority: 2

Title: EXPAND THE EXISTING HYDROLOGIC MONITORING NETWORK

Funding Status: Funded: 30.0 Unfunded: 90.0

Servicewide Issues : N11 (WATER QUAL-EXT)
N20 (BASELINE DATA)
Cultural Resource Type : C70
RMAP Program codes : Q01

Problem Statement

The Preserve needs to expand its existing hydrologic monitoring network to adequately address the boundary expansion, changes in internal and external land uses, and inadequacies in the current program. The increase in external influences (i.e., nutrient enrichment, modified water deliveries) on the Preserve's watershed and the continuous internal influences from recreational and traditional land uses, has created the immediate need to expand the existing monitoring network. This project is proposed to follow BICY-N-001 (Assess Hydrological Monitoring Network), and implement the findings of that evaluation.

One of the primary external threats to the quality of waters within the Preserve's watershed is the expansion of agriculture along the northern boundary of the Preserve. Between 1980 and 1990, citrus acreage doubled to 150,000 acres (Mazzotti, et al., 1992) and is projected to reach 200,000 acres by the year 2000. It will be important to modify the monitoring network, as necessary, to meet the dynamic demands from various land use practices on the Preserve's water resources. If the monitoring network does not provide a good representation of the Preserve's water resources, changes in the water quality and/or water stage may go undetected in areas not adequately monitored.

The Preserve is underlain largely by an extensive surficial aquifer (Shallow Aquifer). At its eastern edge, the Preserve abuts the western part of the Biscayne Aquifer. These aquifer systems are within 10 feet of the surface. The aquifers are recharged by rainfall during the wet season (May - October), and overland flow occurs when the aquifers are saturated. Thus, the sheet flow produced during the wet season represents a surface expression of ground water from the Shallow and Biscayne Aquifers. It is evident from this that a strong interaction between surface water and ground water exists and monitoring of the shallow ground water is critical toward providing a comprehensive evaluation of the Preserve's water resources. Knowledge of the surficial ground water quality and stage in the Preserve is limited to five ground water monitoring wells maintained by the U.S. Geological Survey. The distribution of these wells is restricted to the major roads (i.e., Interstate 74 & State Route 29) in the area. The Preserve does not currently monitor ground water and, as a result, during the dry season (November - April) when the water table drops below the topographic surface, water quality and water stage data are not collected from several monitoring stations. Installation of ground water monitoring wells which compliment the Preserve's existing monitoring network is needed to provide a comprehensive evaluation of the water resources.

The 729,000 acre Preserve is a unique water-dependent ecosystem. As much as 90 percent of the Preserve is inundated to depths ranging from a few inches to more than three feet during the wet season. During the dry season, water levels recede, reducing the areas inundated to approximately 10 percent. The ecology of the Preserve is finely tuned to the seasonal flow of unpolluted water and any interference can alter this sensitive habitat. As a result, it will be important to modify the current hydrological monitoring network to ensure that the water resources are being adequately assessed.

The hydrological monitoring network has expanded from 11 stations in 1988 to a current network of 14 stations. The expansion of the Preserve by approximately 20 percent has supported the need to increase the number of monitoring stations. One of the primary purposes for the establishment of the Preserve was to protect the waters which drain from the Big Cypress

Swamp watershed and into Everglades National Park. A complete monitoring network is essential for accomplishing this objective.

Description of Recommended Project or Activity

The objectives of this project are to:

- Expand the number of existing monitoring stations, as identified in BICY-N-001 (Assess the Hydrologic Monitoring Network).
- Incorporate ground water monitoring into the existing network.
- Modify the water quality parameters, as necessary, for proper evaluation of potential impacts to the water resources.

The program will accomplish these objectives as follows:

1. Implement the recommendations proposed in Project Statement BICY-N-001 (Assess Hydrologic Monitoring Network).

2. Initiate cooperative efforts with various external agencies (i.e., South Florida Water Management District, U.S. Geological Survey, U.S. Army Corps of Engineers) for support to expand the existing monitoring network. The South Florida Water Management District currently provides the Preserve with all the necessary equipment upgrades for the existing monitoring network, including the laboratory analyses for specific water quality parameters. The Preserve provides personnel to collect the water quality samples and water stage data on a scheduled frequency following strict Quality Assurance/Quality Control procedures.

3. Establish a base-funded position (GS-7) for the necessary personnel to meet the increased demands for continuous data collection and station maintenance.

4. Install additional surface water and ground water quality monitoring stations which include automated water stage recorders. Also include additional meteorological monitoring equipment at appropriate stations, as necessary.

5. Survey all new monitoring stations to a common datum and input into the Preserve's Geographic Information System.

6. Upon completion of expanding the Preserve's monitoring network (2-3 years) with the financial support from external agencies (i.e., South Florida Water Management District), a base increase for two FTE's (GS-9/11) will be necessary to assist the existing staff in operation (i.e., data management) of the expanded network.

Literature Cited

Mazzotti, F.J., L.A. Brandt, and Others, 1992. An Evaluation of the Regional Effects of New Citrus Development on the Ecological Integrity on Wildlife Resources in Southwest Florida: Final Report, South Florida Water Management District, West Palm Beach, Florida. 187 pp.

BUDGET AND FTEs:

----------FUNDED----------

	Source	Activity	Budget ($1000's)	FTEs
1995:	PKBASE-NR	MON		0.2
	ST-LOCAL	MON	30.0	
1996:				
1997:				
1998:				
		Total:	30.0	0.2

----------UNFUNDED----------

	Source	Activity	Budget ($1000's)	FTEs
1995:				
1996:	TEMP$-NR	MON		0.5
	ST-LOCAL	MON	15.0	
	NPS	MON	15.0	
1997:	TEMP$-NR	MON		0.5
	ST-LOCAL	MON	15.0	
	NPS	MON	15.0	
1998:	TEMP$-NR	MON		0.5
	ST-LOCAL	MON	15.0	
	NPS	MON	15.0	
		Total:	90.0	1.5

Compliance codes: EXCL

Explanation: 516 DM6 App. 7.4 E(3)

End of data

BICY-N-034.000
Priority: 3

Title: PREPARE ANNUAL WATER RESOURCES REPORTS

Funding Status: Funded: 0.0 Unfunded: 16.0

Servicewide Issues : N20 (BASELINE DATA)

Cultural Resource Type : C70
RMAP Program codes : Q01

Problem Statement

Annual water resources reports are needed to provide a timely understanding of the condition of the Preserve's water resources for park management and regional water and land managers (i.e., U.S. Geological Survey, South Florida Water Management District, U.S. Army Corps of Engineers, Everglades National Park, etc.). The Preserve has collected water stage and water quality data continuously since 1988 without an adequate assessment of the hydrological information since 1989. The majority of the water stage charts have not been digitized, producing a large backlog of surface water elevation data in the Preserve. Water quality data has been entered into a database but statistical summaries on the data have not been conducted to identify and evaluate trends and/or anomalies for the various water quality parameters because of budgetary and staffing constraints.

The 729,000 acre Preserve is a unique water dependent ecosystem resulting from a combination of its climate and physiographic setting: the climate provides the hydrologic input; the physiographic setting controls distribution of the input. As much as 90 percent of the Preserve is inundated to depths ranging from a few inches to more than three feet during the wet season (May-October). During the dry season (November-April), water levels recede, reducing the areas inundated in the Preserve to approximately 10 percent. The ecology of the Preserve is finely tuned to the seasonal flow of unpolluted water and any interference can alter this sensitive habitat. As a result, a comprehensive evaluation of the hydrological data each year is critical toward protecting the water resources of the Preserve.

The hydrological monitoring network has expanded from 11 stations in 1988 to a current monitoring network of 14 stations. The expansion of the Preserve by approximately 20 percent has increased the need for timely assessments of the hydrological data in order to identify anomalies in water quality and/or water stage. The external influences (i.e., agriculture) on the additional 147,280 acres magnifies the need for continuous assessments on a scheduled frequency. The stated purpose of the Additions Act (P.L. 100-301) includes protection of the lands from intrusive activities which might impact the watersheds that drain directly into Everglades National Park.

The 1995 Cooperative Agreement between the South Florida Water Management District and Preserve requires an annual summary report of the Preserve's hydrological information. The Cooperative Agreement is a strong asset for the Preserve's hydrology program since it provides the Preserve with the necessary financial support (i.e., water quality analysis, field equipment, etc.) to maintain the existing monitoring network.

Description of Recommended Project or Activity

An annual water resources report will be prepared providing a summary of water quality and water stage data, significant hydrologic events and trends for each respective year. This will meet the needs of the Preserve's management and will fulfill the requirements of the Preserve's Cooperative Agreement with the South Florida Water Management District.

This project will entail the production of an annual summary report, which includes the following elements, and is available for internal use and submitted to the appropriate agencies (i.e., South Florida Water Management District, U.S. Geological Survey, U.S. Army Corps of Engineers, Everglades National Park, National Park Service: Water Resources Division):

1. Use of the appropriate data management software to provide summaries (i.e., graphs, tables) of various hydrologic data.

2. A comparison of historical and current hydrologic data to identify trends and/or anomalies..

3. Geographic Information System maps depicting isopleths for water stage and concentrations for specific water quality parameters.

4. A narrative which summarizes any hydrological trends or anomalies (water quality or quantity).

In order to produce an annual summary report which is most useful to management and provides adequate monitoring of potential anomalies and long-term trends, a standardized format will be used to record, list and display all data. All data will be graphically plotted on a yearly basis. These graphs will be prepared to show extreme values (maximum & minimum), median values, 25th and 75th percentiles.

Separate graphs will be prepared for each of the monitoring sites to show the following:

- Yearly trends (one box & whiskers graph representing on years data) for each site.
- Yearly trends for each parameter for all monitoring stations combined.
- A yearly comparison of differences between sites (one bar & whiskers graph representing one site).
- A yearly comparison of each month's data for each parameter (one bar & whiskers graph representing one month's data).

This project will support the efforts to complete an annual hydrological assessment for the Preserve which summarizes the water quality and water stage for each respective year. The primary purpose of the hydrological reports is to provide an "early warning" detection of deteriorating water quality and/or changes in baseline water stage in the Preserve and to participate in the mutual information exchange among agencies active in water management in south Florida.

The Preserve has most of the necessary software and computer equipment to prepare the required statistical graphics and location maps. The first two years of this project will require funding to establish a standardized report format, as previously described. After the report format is developed, including data processing, the remaining annual cost for this project will be for reproduction of the report for local distribution.

BUDGET AND FTEs:

----------FUNDED----------

	Source	Activity	Budget ($1000's)	FTEs
1995:	PKBASE-NR	RES		0.1
1996:	PKBASE-NR	RES		0.1
1997:	PKBASE-NR	RES		0.1
1998:	PKBASE-NR	RES		0.1
		Total:	0.0	0.4

----------UNFUNDED----------

	Source	Activity	Budget ($1000's)	FTEs
1995:				
1996:	PKBASE-NR	RES	3.0	
	NPS	RES	3.0	
1997:	PKBASE-NR	RES	3.0	
	NPS	RES	3.0	
1998:	PKBASE-NR	RES	4.0	
		Total:	16.0	0.0

Compliance codes: EXCL

Explanation: 516 DM6 App. 7.4 A(9)
516 DM6 App. 7.4 b(10)

End of data

BICY-N-074.000
Priority: 4

Title: DEVELOP A WATER QUALITY BASELINE FOR THE PRESERVE

Funding Status: Funded: 0.0 Unfunded: 35.0

Servicewide Issues : N11 (WATER QUALITY)

Cultural Resource Type : N/A
RMAP Program codes : Q01, Q02

Problem Statement

The development of a numeric baseline of water quality conditions is necessary in order to implement the non-degradation water quality standards which apply to the Preserve. The waters of Big Cypress National Preserve are currently designated as Outstanding Florida Waters. This is a state designation under the Clean Water Act, intended to afford the highest level of protection to existing high quality waters.

One of the provisions under the Outstanding Florida Waters designation is the establishment of a baseline year for defining the existing ambient water quality (62-302.700 (8) and (9) F.A.C.). The Preserve currently has three designated baseline dates due to the addition of new lands that changed the boundaries of the Outstanding Florida Waters designation. The dates of May 14, 1986, April 19, 1988 and August 8, 1994, apply to portions of the Preserve. Under Florida Statutes, Section 62-4.242 (2) (c), the baseline period is the 12 month period prior to the designated date. In absence of good data during the baseline year, the state will accept best professional judgement in some cases, and, where there is no reason to expect that quality had changed, a different period with a better database might be assumed to represent the official baseline year.

The Preserve is evaluating the desirability of an Outstanding National Resource Waters designation, which provides an even greater level of protection against water quality degradation (see project statement BICY-N-207.000). If the Preserve succeeds in this effort, the new designation will also require the establishment of a baseline, which in this case will cover a five year period opposed to one year.

The 729,000 acre Preserve is a unique water-dependent ecosystem. As much as 90 percent of the Preserve is inundated to depths ranging from a few inches to more than three feet during the wet season (May-October). During the dry season (November-April), water levels recede, reducing the areas inundated to approximately 10 percent. The wetlands ecology of the Preserve is finely tuned to the seasonal flow of unpolluted water and any interference can alter this sensitive habitat. Recognizing this, congress established that the primary purpose for the Preserve is, "...to assure the preservation, conservation, and protection of the natural, scenic, hydrologic, flora and faunal, and recreational values of the Big Cypress Watershed".

With very few exceptions, water quality in the Preserve is very high, and represents natural conditions more closely than any other waters in south Florida. Water quality in the Preserve is vulnerable to degradation from internal or external contaminants, simply because it has such high quality water, that even small amounts of contaminants can result in relatively large degradation. Maintaining a healthy ecosystem in this water-dominated Preserve requires maintaining an excellent water quality.

Description of Recommended Project or Activity

The Preserve's objective for this project is to establish a numeric water quality baseline which will provide the foundation for identifying water quality degradation. Establishment of these standards will provide long-term protection for the Preserve consistent with the anti-degradation provisions of the Clean Water Act and Florida Statutes.

The program will accomplish this objective through the following steps:

1. Assemble data available in the Preserve and from external sources.

2. Conduct preliminary analyses on the Preserve's historical water quality data to determine if the database appears to be sufficient to characterize the ambient water quality conditions, during the designated baseline period, for specific areas of the Preserve. This must include key parameters, and represent natural spacial and seasonal variability.

3. Where the database is inadequate for the baseline year, identify an alternative period that, based on continuity of land and water use patterns and the available data record, is representative of ambient water quality during the baseline year.

4. Coordinate with the Florida Department of Environmental Protection to get their concurrence on the statistical methodology to be used, and, if necessary, to identify alternative data periods that represent the baseline periods. An adequate statistical analysis may require several years of data, which will necessitate concurrence that this data record is representative of the designated baseline period.

5. Employ appropriate statistical techniques to derive confidence interval estimates for the 0.85, 0.90 and 0.95 level quantiles from the selected parameters defined in #1. A confidence level of 0.95 or greater should be used, if possible (Breidt et al., 1991).

6. Present the results to the Florida Department of Environmental Protection for adoption as representative of baseline water quality conditions to be protected from degradation under Florida laws and regulations.

The distribution-free confidence interval estimation technique is one statistical tool for deriving water quality criteria for the Preserve. This technique is quite flexible in that various quantiles of interest can be selected (e.g., .85, .90, .95, etc.) depending upon the degree of water quality protection desired (Breidt et al., 1991). As a result, more than one level of protection can be employed which can include a warning level for impacts to water quality. This would accommodate the Preserve's dynamic need to establish zones with different water quality standards.

Sufficient water quality data is thought to exist to provide a numeric base for antidegradation criteria in large parts of the Preserve. It is very unlikely that water quality is sufficiently uniform across the Preserve to permit a single set of baseline criteria. Several sets of criteria representing the various drainage systems and regions of the Preserve are the likely outcome. If the water quality database is found to be entirely inadequate in some portion of the Preserve, the establishment of baseline criteria for those areas would have to be differed until an adequate database can be established. These areas would be a top priority for new water quality monitoring stations.

It is anticipated that this project will be accomplished through a contract or cooperative agreement with the team consisting of, at a minimum, a statistician and water quality specialists. Coordination with the Florida Department of Environmental Protection is obviously an important part of this project, because the National Park Service will be asking them to adopt the results as an element of the state water quality regulations.

Literature Cited

Breidt, J.F., D.C. Boes, J.I. Wagner and M.D. Flora, 1991. Antidegradation Water Quality Criteria for the Delaware River: A Distribution-Free Statistical Approach. American Water Resources Association, Water Resources Bulletin, Vol. 27, No. 5. 849-850, 856-857 pp.

BUDGET AND FTEs:

----------FUNDED----------

	Source	Activity	Budget ($1000's)	FTEs
1995:				
1996:				
1997:				
1998:				
		Total:	0.0	0.0

----------UNFUNDED----------

	Source	Activity	Budget ($1000's)	FTEs
1995:				
1996:				
1997:	PKBASE-NR	RES	10.0	0.3
	NPS	RES	25.0	
1998:				
		Total:	35.0	0.3

Compliance codes: OTHER

Explanation: 516 DM2 App. 2, 2.10

End of data

BICY-N-097.000
Priority: 5

Title: INCORPORATE EXTERNAL AND INTERNAL METEOROLOGICAL INFORMATION INTO HYDROLOGICAL DATABASE

Funding Status: Funded: 0.0 Unfunded: 7.0

Servicewide Issues : N20 (BASELINE DATA)

Cultural Resource Type : N/A
RMAP Program codes : A03, Q01

Problem Statement

Big Cypress National Preserve's Hydrology Program does not have a comprehensive meteorological (MET) database which includes data from the existing MET monitoring networks. There is a need for cooperative efforts between the Preserve and various external sources (i.e., National Oceanic and Atmospheric Administration, South Florida Water Management District, Everglades National Park) to obtain all available MET information relevant to the Preserve's water resources. Both the amount of rainfall and its seasonal distribution are highly variable in south Florida (Duever et al., 1986); therefore, the need for an extensive MET monitoring network is necessary to better define precipitation throughout the Preserve.

The 729,000 acre Preserve is a unique water-dependent ecosystem resulting from a combination of its climate and physiographic setting: the climate provides the hydrological input; the physiographic setting controls the distribution of the input. As much as 90 percent of the Preserve is inundated to depths ranging from a few inches to more than three feet during the wet season (May-October). During the dry season (November-April), water levels recede, reducing the areas inundated in the Preserve to approximately 10 percent. The ecology of the Preserve is finely tuned to a seasonal flow of water and any interference can alter this sensitive habitat. As a result, it is important to have an adequate MET monitoring network for evaluating impacts from precipitation at different locations within the Preserve.

MET data is currently collected by the Preserve's fire program and other external sources (i.e., Seminole Big Cypress Reservation, South Florida Water Management District, Everglades National Park, etc.) within the Big Cypress Swamp watersheds. The Preserve's Fire Division currently maintains seven meteorological stations in the Preserve. Data collected from these sources are not in a format which can currently be incorporated into the hydrology computer database.

Precipitation is an important component of the water budget, thus representative precipitation data within the Preserve's watershed is critical in development of the hydrological equation which calculates the water budget. The information collected from this project will compliment the information collected from BICY-N-202 (Support Evapotranspiration Monitoring Efforts). The U.S. Geological survey has FY 96 funding for the installation of an evapotranspiration monitoring station in the Preserve, which is another critical component to the water budget.

Description of Recommended Project or Activity

The objective of this project is to expand the Preserve's existing MET monitoring network to provide a more complete picture of precipitation and evapotranspiration in the Preserve.

This project will accomplish this objective as follows:

1. Obtain existing (historical) MET data from various external sources (i.e., National Oceanic and Atmosphere Administration, South Florida Water Management District, Everglades National Park). The

MET data should not be restricted to the Preserve boundaries but include the entire watersheds of the Preserve.

2. Prepare the MET data (historical) into a compatible database format for the hydrology program.

3. Input all appropriate MET locations into the Preserve's Geographic Information System database.

4. Develop and implement procedures for the electronic transfer of future MET data from appropriate external sources and the Preserve's Fire Division on a scheduled frequency.

This project will require 1-2 years to initially establish. Short-term funding necessary for the establishment of the project will include preparation of a computer database for inputting precipitation data, and purchasing of appropriate computer software and modem. Based on the scheduled deliveries of data, a dedicated computer (i.e., 286) may be needed to accommodate the electronic transfer of data. After the database management system is developed and the sources and data exchange format identified, long-term (base funding) for 0.1 FTE/year (GS-7) would be necessary to maintain the on-going project. This GS-7 scientist would be supported by the supervisory hydrologist, as indicated by the funded budget (0.05/year). The GS-7 FTE could also support the personnel needs for project statements BICY-N-099, BICY-N-100, and BICY-N-103.

Literature Cited

Duever, J.D., J.E. Carlson, J.F. Meeder, L.C. Duever, L.H. Gunderson, L.A. Riopelle, T.R. Alexander, R.L. Meyers and Daniel P. Spangler, 1986. The Big Cypress National Preserve. Research Report No. 8 of the National Audubon Society. 7 p.

BUDGET AND FTEs:

	FUNDED			
	Source	Activity	Budget ($1000's)	FTEs
1995:				
1996:	PKBASE	MON		0.05
1997:	PKBASE	MON		0.05
1998:	PKBASE	MON		0.05
		Total:	0.0	0.15

----------UNFUNDED----------

	Source	Activity	Budget ($1000's)	FTEs
1995:				
1996:	PKBASE-NR	MON		0.1
	NPS	MON	5.0	
1997:	PKBASE-NR	MON		0.1
	NPS	MON	2.0	
1998:	PKBASE-NR	MON		0.1
		Total:	7.0	0.3

Compliance codes: EXCL

Explanation: 516 DM2 App. 1.6

End of data

Title: INVENTORY FLOW IMPEDIMENTS AND WATER CONTROL STRUCTURES

Funding Status: Funded: 1.0 Unfunded: 16.0

Servicewide Issues : N12 (WATER FLOW)
N20 (BASELINE DATA)

Cultural Resource Type : C70, C57
RMAP Program codes : Q01

Problem Statement

Big Cypress National Preserve does not have a complete and accurate inventory of surface water flow impediments and water control structures located within the Preserve. This information is critical toward understanding the surface and ground water flows in the Preserve.

The 729,000 acre Preserve is a unique water-dependent ecosystem resulting from a combination of its climate and physiographic setting: the climate provides the hydrological input; the physiographic setting controls the distribution of the input. As much as 90 percent of the Preserve is inundated to depths ranging from a few inches to more than three feet during the wet season (May-October). During the dry season (November-April), water levels recede, reducing the areas inundated in the Preserve to approximately 10 percent. The ecology of the Preserve is finely tuned to the seasonal flow of water and any interference can alter this sensitive habitat. As a result, it is important to accurately locate all flow impediments and water control structures located within the Preserve which will assist with future hydrologic model applications and drainage definition.

Several major structures (i.e., roads, canals) are present within the Preserve's boundary which either impede or accelerate the natural flow regime. These major structures include:

- Interstate 75 - a 28-mile segment of interstate (including a borrow canal), which travels east-west across the north end of the Preserve.
- U.S. Highway 41 - a 36-mile segment of highway (including a borrow canal), which travels east-west across the middle of the Preserve.
- County Route 94 (Loop Road) - a 23-mile segment of gravel and asphalt road (including a borrow canal), which travels from Monroe Station to Forty Mile Bend.
- State Route 29 - a 28-mile segment of asphalt road (including a borrow canal), which travels north-south along the western boundary of the Preserve.
- County Route 839 (Turner River Road) - a 20-mile segment of gravel road which travels south from just north of I-75 to U.S. Hwy. 41 in the west end of the Preserve.
- L-28 and L-28 Tieback Canal and Levee - a 14-mile segment of canal/levee which travels north-south along the eastern boundary of the Preserve.
- L-28 Interceptor Canal and Levee - a 9-mile segment of canal/levee which travels northwest-southeast across the northeast part of the Preserve.

Along with these major structures there are numerous minor roads and canals within the Preserve, which also have a significant influence on the hydrology.

In an attempt to re-establish natural flow conditions along these structures, numerous bridges and culverts have been installed across the roadways allowing drainage of surface water across the roadways. Earthen plugs or stop-log weirs are also installed in some canals to restrict the rapid drainage of surface and ground water. Each year additional water control structures (i.e., culverts, earthen plugs) are installed in the Preserve to either replace existing structures or to further enhance existing control structure networks.

The long range management objective of the Preserve is to mitigate, or where possible, eliminate the impacts of all structures that alter the natural flow regime of the Preserve. To date, the approach toward addressing impacts caused by these structures has been inconsistent, resulting in actions where problems are most obvious or cause complaints, such as the inundation of Loop Road. A comprehensive inventory of the location, size and characteristics of all flow impediments and water control structures in the Preserve would make a systematic approach to understanding and mitigating their impacts possible.

Description of Recommended Project or Activity

The objective of this inventory is to define all man-made structures which influence the Preserve's hydrology. This inventory will assist with future hydrologic modeling applications and surface and ground water flow definition. To accomplish these objectives this project will include the following components:

1. Survey locations and elevations for all man-made structures (i.e., roads, canals, bridges, culverts, weirs, earthen plugs) which influence the natural hydrologic conditions within the Preserve.

2. Conduct a detailed inventory for each structure which includes; size and general condition.

3. Import survey data into the Preserve's Geographic Information System (GIS).

4. Develop a computer inventory database for storing the specific information (size, etc.) collected on each structure.

5. Conduct a survey of structures in the Preserve every five years and update the Geographic Information System database, as necessary.

6. Prepare a qualitative and/or quantitative assessment of the relative impact to surface and ground water flows caused by each structure.

Although many of the major water control structure locations (i.e., bridges along Interstate 75 and U.S. Highway 41) are available through Florida Department of Transportation and U.S. Army Corps of Engineers, many of the culverts and canal weirs along the smaller county roads in the Preserve are not included in any inventory location files. Thus, the information from this project will be very important data for the various Federal, state and county agencies. The Preserve has Global Positioning System (GPS) equipment, software and trained staff to accurately locate the various water control structures and flow impediments. The Preserve also has a GIS and trained staff for properly importing the GPS location data into the GIS. The various structures and impediments are accessible by vehicle, excluding the L-28 Levee and Tieback systems which are accessible by the Preserve helicopter. The Preserve also has a set of 1990 high-altitude photographs (scale: 1:24,000) of the entire Preserve for digitizing structures and flow impediments, as necessary. The best time for accomplishing this project would be during the dry season (November - April) when optimum conditions exist for field work.

The National Park Service (Water Resources Division) and Preserve have spent $1000 and 0.1 FTE, respectively, in 1995 to inventory the culverts along Loop Road. This work complimented the $180,000 culvert installation project conducted by Monroe County. The original culvert location data that Monroe County had for Loop Road was found to be inaccurate and as a result, the Preserve completed another inventory of the culverts along Loop Road, including the newly installed

culverts, in 1995. This inventory data has been used by the Preserve, Monroe County, South Florida Water Management District and U.S. Army Corps of Engineers to assist with water management projects in the immediate area.

BUDGET AND FTEs:

----------FUNDED----------

	Source	Activity	Budget ($1000's)	FTEs
1995:	PKBASE-NR	MON		0.1
	NPS	MON	1.0	
1996:	PKBASE-NR	MON		0.2
1997:	PKBASE-NR	MON		0.2
1998:	PKBASE-NR	MON		0.1
		Total:	1.0	0.6

----------UNFUNDED----------

	Source	Activity	Budget ($1000's)	FTEs
1995:				
1996:	PKBASE-NR	MON	2.0	
	ST-LOCAL	MON	5.0	
1997:	PKBASE-NR	MON	2.0	
	ST-LOCAL	MON	5.0	
1998:	PKBASE-NR	MON	2.0	
		Total:	16.0	0.5

Compliance codes: EXCL

Explanation: 516 DM2 App. 1.6

End of data

Title: IMPROVE TOPOGRAPHIC MAP RESOLUTION

Funding Status: Funded: 0.0 Unfunded: 210.0

Servicewide Issues : N20 (BASELINE DATA)

Cultural Resource Type : N/A
RMAP Program codes : C03, Q01

Problem Statement

Surface flows within the boundaries of Big Cypress National Preserve are not well defined. Accurate topographic data of the Preserve is needed to better understand the duration of inundation and surface water flows. The topography of the Preserve is a primary factor influencing surface water flow patterns. Topographic relief within the Preserve is very minor (< 20 feet of variance), which makes it difficult to completely define surface water flow across the Preserve.

The 729,000 acre Preserve is a unique water-dependent ecosystem resulting from a combination of its climate and physiographic setting: the climate provides the hydrological input; the physiographic setting controls the distribution of the input. As much as 90 percent of the Preserve is inundated to depths ranging from a few inches to more than three feet during the wet season (May-October). During the dry season (November-April), water levels recede, reducing the areas inundated in the Preserve to approximately 10 percent. The ecology of the Preserve is finely tuned to the seasonal flow of water and any interference can alter this sensitive habitat. As a result, an accurate understanding of the topographic variation in the Preserve is critical toward defining natural surface flows and thus providing better management of the water resources.

Man-made alterations of surface water flow in south Florida, which began in the 1920's, has significantly influenced the original surface water hydrology in the Preserve. As water deliveries to the Preserve continue to be influenced by human needs and water flows are altered by unnatural structures (i.e., canals, roads, culverts), the equation toward understanding (i.e., modeling) the dynamics of surface water flow has become increasingly difficult.

Currently available topographic mapping in south Florida is of very little use in determining surface flow patterns because of a large contour interval (> 5 feet). Color IR photographs of south Florida were completed in January 1995 and these photographs were converted to digital orthophoto color (county) maps, which was funded by the U.S. Environmental Protection Agency and U.S. Geological Survey. These affordable ($35) digital county maps will be available to interested parties in September 1996 on CD-ROM. Unfortunately, these maps will be limited to 5-foot contour intervals, which will not provide the detailed topographic variations necessary for defining surface water flow.

Description of Recommended Project or Activity

The U.S. Geological Survey is currently surveying selected quadrangles in south Florida as part of the efforts for the Everglades Restoration Program. These selected quadrangles will be contoured to a 0.5-foot contour interval. The objective of this project is to obtain a complete and accurate topographic survey of the entire Preserve, including the Additions. This objective will be accomplished as follows:

- obtain the quadrangles within the Preserve which were surveyed (1995-96) by the U.S. Geological Survey as part of the Everglades Restoration Program efforts.
- contract U.S. Geological Survey to conduct a topographic survey for quadrangles within the Preserve not included in the Everglades Restoration Program ($25,000 - $50,000/quadrangle).

- digitize the topographical data and import into the Preserve's Geographic Information System.

It will be more cost effective for the Preserve to contract the U.S. Geological Survey while they are working on the survey for the Everglades Restoration Program. The Preserve has received support from the U.S. Army Corps of Engineers for proposing remedial projects tied into the Everglades Restoration Program in the eastern part of the Preserve. This external restoration support is due to a better understanding of the hydrologic connection between the Preserve and Everglades. Therefore, prior to contracting the U.S. Geological Survey to conduct a topographic survey in the Preserve, the Preserve should seek funding through the Everglades Restoration Program to complete some of the Preserve's topographic quadrangles which would assist with the objectives of the Everglades Restoration Program.

The high variability in cost for each quadrangle ($25,000 - $50,000) is due to the varying vegetative and hydrologic conditions. This range in cost was taken from the costs anticipated in Everglades National Park. Accessibility in the Preserve can be less costly than in the Everglades National Park if field work is scheduled during the dry season when the majority of the Preserve is dry. A major element to accomplish this project will include hiring of a base-funded GS-7 scientist for three years to import survey data into the Preserve's Geographic Information System. This project would require approximately 0.2 FTE/year effort of this position. This temporary FTE could also support the personnel needs for project statements BICY-N-097, BICY-N-100 and BICY-N-103.

BUDGET AND FTEs:

----------FUNDED----------

	Source	Activity	Budget ($1000's)	FTEs
1995:				
1996:				
1997:				
1998:				
		Total:	0.0	0.0

----------UNFUNDED----------

	Source	Activity	Budget ($1000's)	FTEs
1995:				
1996:	NRPP	RES	50.0	
	PKBASE-NR	RES	20.0	0.2
1997:	NRPP	RES	50.0	
	PKBASE-NR	RES	20.0	0.2
1998:	NRPP	RES	50.0	
	PKBASE-NR	RES	20.0	0.2
		Total:	210.0	0.6

Alternative Actions/Solutions and Impacts

No Action. This would restrict the topographical data within the Preserve to the 5-foot contour interval opposed to a 0.5-foot contour interval. Interpretation of surface water flow would be severely limited since the topographical variation across the Preserve is less than 20 feet.

Compliance codes: EXCL

Explanation: 516 DM2 App. 1.6

End of data

BICY-N-100.000
Priority: 8

Title: INCORPORATE WATER QUALITY DATA FROM EXTERNAL SOURCES INTO HYDROLOGICAL DATABASE

Funding Status: Funded: 0.0 Unfunded: 5.0

Servicewide Issues :N11 (WATER QUAL-EXT)
N20 (BASELINE DATA)

Cultural Resource Type : C70
RMAP Program codes : Q01

Problem Statement

There is a continuous need for cooperative efforts between the Preserve and various external sources (i.e., South Florida Water Management District, U.S. Geological Survey) to obtain all available water quality information relevant to the Preserve's water resources. Water quality data are being collected on a scheduled frequency by the South Florida Water Management District and U.S. Geological Survey within the Preserve's watersheds. This information is currently not incorporated into the Preserve's water quality database and ultimately into the Preserve's resource management decisions.

The 729,000 acre Preserve is a unique water dependent ecosystem resulting from a combination of its climate and physiographic setting: the climate provides the hydrologic input; the physiographic setting controls distribution of the input. As much as 90 percent of the Preserve is inundated to depths ranging from a few inches to more than three feet during the wet season (May-October). During the dry season (November-April), water levels recede, reducing the areas inundated in the Preserve to approximately 10 percent. The ecology of the Preserve is finely tuned to the seasonal flow of non-polluted water and any interference can alter this sensitive habitat. As a result, expansion of the water quality monitoring network, through incorporation of hydrological data from external sources, will provide the Preserve with a more complete assessment of its water resources.

It is important not to restrict the assessment of water quality data to the boundaries of the Preserve. Appropriate assessments of water quality need to include data collected from within all the Preserve's watersheds. This will allow for better definition and understanding of the Preserve's water quality. For example, early detection of water quality problems outside the Preserve's boundaries but within the Preserve's watershed, will allow for a proactive approach toward water resource management decisions.

There are three general watersheds that extend into the Preserve's boundaries. These three watersheds are:

1. A broad band occupying most of the original Preserve, of southwest trending sloughs and strands separated by marl prairies and pinelands in its eastern portion to an interior highland of domes, hammocks and pines. Water flows within this watershed are in a south to southwest direction.
2. In the Additions to the north, a broad, interior lowland channel with an aggregation of sloughs and hammock islands that drain directly into the Everglades. Water flows within this watershed are in a south to southeasterly direction.
3. In the northwestern corner of the Preserve, a small area of marshes, ponds, prairies, hammocks and sloughs that drain into Fakahatchee Strand west of the Preserve. Water flows within this watershed are in a south to southwesterly direction.

The persistent southward progression of agricultural development presents an external threat to the water quality of all three of these watersheds. Expanding agricultural development is now located along the Preserve's northern boundary. Each of these watersheds extend from these agriculturally active areas north of the Preserve and into the Preserve. Therefore it is

critical that the Preserve incorporate water quality data from the various external sources to provide a comprehensive assessment of water quality in the area and to better identify contamination threats to its water resources.

Description of Recommended Project or Activity

The objective of this project is to expand the Preserve's existing water quality monitoring network and database. The program will accomplish this objective as follows:

1. Obtain existing water quality data from external sources (i.e., South Florida Water Management District, U.S. Geological Survey).

2. Identify appropriate water quality data for inclusion into the Preserve's water quality database. This would include water quality data collected from the Preserve's watersheds.

3. Prepare external water quality data (historical) into compatible database format (i.e., Hydrologic Engineering Center Data Storage System (HEC-DSS)).

4. Develop and implement procedures for the electronic transfer of future water quality data from external sources on a scheduled frequency.

5. Incorporate water quality data collected from external sources into the Preserve's water quality database.

Conversion and transfer of existing data will be accomplished during the first year of the project. Subsequent years will require 0.1 FTE (GS-7 scientist) of base funded effort to facilitate continuing data exchange. This FTE could support the personnel needs for project statements BICY-N-097, BICY-N-099, and BICY-N-103.

BUDGET AND FTEs:

----------FUNDED----------			
Source	Activity	Budget ($1000's)	FTEs
1995:			
1996:			
1997:			
1998:			
	Total:	0.0	0.0

----------UNFUNDED----------

	Source	Activity	Budget ($1000's)	FTEs
1995:				
1996:	NPS	MON	5.0	
	PKBASE-NR	MON		0.1
1997:	PKBASE-NR	MON		0.1
1998:	PKBASE-NR	MON		0.1
		Total:	5.0	0.3

Alternative Actions/Solutions and Impacts

No action. This alternative would limit the Preserve's water quality database to information collected by the Preserve. Evaluation of water quality data from external sources would be restricted to summary reports, if available, prepared by the respective state and Federal agencies.

Compliance codes: EXCL

Explanation: 516 DM2 App. 1.6

End of data

BICY-N-103.000
Priority: 9

Title: INCORPORATE WATER STAGE DATA FROM EXTERNAL SOURCES INTO HYDROLOGICAL DATABASE

Funding Status: Funded: 0.0 Unfunded: 10.0

Servicewide Issues : N12 (WATER FLOW)
N20 (BASELINE DATA)

Cultural Resource Type : C70
RMAP Program codes : Q01

Problem Statement

There is a need for cooperative efforts between the Big Cypress National Preserve and various external sources (i.e., South Florida Water Management District, U.S. Geological Survey, U.S. Army Corps of Engineers) to obtain all available water stage information relevant to the Preserve's water resources. Water stage data is being collected on a scheduled frequency by the South Florida Water Management District and U.S. Geological Survey within the Preserve's watersheds. This information is currently not incorporated into the Preserve's water stage database and ultimately into the Preserve's resource management decisions.

The 729,000 acre Preserve is a unique water dependent ecosystem resulting from a combination of its climate and physiographic setting: the climate provides the hydrologic input; the physiographic setting controls distribution of the input. As much as 90 percent of the Preserve is inundated to depths ranging from a few inches to more than three feet during the wet season (May-October). During the dry season (November-April), water levels recede, reducing the areas inundated in the Preserve to approximately 10 percent. The ecology of the Preserve is finely tuned to the seasonal flow of water and any interferences can alter this sensitive habitat. As a result, it is important to have a complete water stage database to better define surface flows in the Preserve.

It is important not to restrict the assessment of water stages to the boundaries of the Preserve. Appropriate assessments of water flows need to include data collected from the Preserve's entire watersheds. This will allow for better definition and understanding of the flow regimes in the Preserve. For example, early detection of water quantity problems outside the Preserve's boundaries but within the Preserve's watershed will allow for a proactive approach toward water resource management decisions.

There are three general watersheds that extend into the Preserve's boundaries. These three watersheds are:

1. A broad band occupying most of the original Preserve, of southwest trending sloughs and strands separated by marl prairies and pinelands in its eastern portion to an interior highland of domes, hammocks and pines. Water flows within this watershed are in a south to southwest direction.
2. In the Additions to the north, a broad, interior lowland channel with an aggregation of sloughs and hammock islands that drain directly into the Everglades. Water flows within this watershed are in a south to southeasterly direction.
3. In the northwestern corner of the Preserve, a small area of marshes, ponds, prairies, hammocks and sloughs that drain into Fakahatchee Strand west of the Preserve. Water flows within this water shed are in a south to southwesterly direction.

The persistent southward progression of agricultural development and increasing population growth presents an external threat to the water quantity of all three of these watersheds. Expanding agricultural development is now located along the Preserve's northern boundary. Each of these watersheds extend from these agriculturally active areas north of the Preserve and into the Preserve. Therefore it is critical that the Preserve incorporate water quantity data from the various external sources to provide a comprehensive assessment of water stage in the area and to better identify anomalies in water stage which could potentially impact the natural resources of the Preserve.

Description of Recommended Project or Activity

The objective of this project is to expand the Preserve's existing water stage monitoring network. The project will accomplish this objective as follows:

1. Obtain existing water stage data from external sources (i.e., South Florida Water Management District, U.S. Geological Survey, U.S. Army Corps of Engineers).

2. Identify appropriate water stage data for inclusion into the Preserve's water stage database. This would include water levels collected from the Preserve's watersheds.

3. Prepare external water stage data (historical) into compatible database format (i.e., Hydrologic Engineering Center Data Storage System (HEC-DSS)).

4. Develop and implement procedures for the electronic transfer of future water stages from external sources on a scheduled frequency using the Generalized Data Exchange Format for interagency data collection and transfer. This format has been adopted by the U.S. Geological Survey, U.S. Army Corps of Engineers, South Florida Water Management District and Everglades National Park.

5. Incorporate water stage data collected from external sources into the Preserve's water stage database.

Conversion and transfer of existing data will be accomplished during the first year of the project. Subsequent years will require 0.1 FTE (GS-7 scientist) of base funded effort to facilitate continuing data exchange. This FTE could also support the personnel needs for project statements BICY-N-097, BICY-N-099 and BICY-N-100.

BUDGET AND FTEs:

----------FUNDED----------

	Source	Activity	Budget ($1000's)	FTEs
1995:				
1996:				
1997:				
1998:				
		Total:	0.0	0.0

----------UNFUNDED----------

	Source	Activity	Budget ($1000's)	FTEs
1995:				
1996:	NPS	MON	5.0	
	PKBASE-NR	MON		0.1
1997:	NPS	MON	5.0	
	PKBASE-NR	MON		0.1
1998:	PKBASE-NR	MON		0.1
		Total:	10.0	0.3

Alternative Actions/Solutions and Impacts

No action. This alternative would limit the Preserve's water stage database to information collected by the Preserve. Evaluation of water stage data from external sources would be restricted to summary reports, if available, prepared by the respective state and Federal agencies.

Compliance codes: EXCL

Explanation: 516 DM2 App. 1.6

End of data

BICY-N-104.000
Priority: 10

Title: INVENTORY INTERNAL LAND USE

Funding Status: Funded: 0.0 Unfunded: 55.0

Servicewide Issues : N18 (VIS USE-BCTRY)
N22 (VIS USE-DEV ZN)
N24 (OTHER)
Cultural Resource Type : C70
RMAP Program codes : C03, Q01

Problem Statement

A comprehensive inventory of all current and past land uses in the Preserve, and their respective areas of influence has not been conducted. As a result, impacts to the Preserve's water resources from these internal land uses are not fully understood. The various internal land uses in the Preserve include the following:

1. Recreational - various recreational activities (i.e., off-road vehicle (ORV) operation, hunting, camping, fishing, and hiking) are common in the Preserve.

2. Inholdings - privately owned parcels scattered throughout the Preserve are classified as improved properties and are exempt from acquisition.

3. Oil & Gas - exploration for and development of private oil, gas and other minerals within the Preserve is allowed under PL 93-440 and subject to National Park Service regulations.

4. Traditional Indian Land Use - PL 93-440 provides that members of the Miccosukee and Seminole Tribes of Florida would be allowed their usual and customary use and occupancy of Federal lands and waters within the Preserve.

5. Grazing - approximately 29,000 acres within the Preserve's original boundary are leased for grazing.

The 729,000 acre Preserve is a unique water-dependent ecosystem resulting from a combination of its climate and physiographic setting: the climate provides the hydrological input; the physiographic setting controls the distribution of the input. As much as 90 percent of the Preserve is inundated to depths ranging from a few inches to more than three feet during the wet season (May-October). During the dry season (November-April), water levels recede, reducing the areas inundated in the Preserve to approximately 10 percent. The ecology of the Preserve is finely tuned to the seasonal flow of water and any interference can alter this sensitive habitat. As a result, the internal land uses which might impact water quality or water flows, should be identified and the respective areas of influence defined.

Description of Recommended Project or Activity

This project will require an analysis of land use information gathered from internal and external sources to identify the various internal land uses and define the approximate boundaries of each respective land use. The primary objective of the project is to provide a complete inventory database of internal land uses which can be expanded upon in the future. This data will be compared with the Preserve's water quality and quantity databases to identify correlations, if any, between degradation of the water resources and specific internal land use(s).

The project will accomplish this objective as follows:

1. Identify the various historical and current land uses in the Preserve utilizing external and internal sources. Examples of external sources include Florida's Game and Fresh Water Fish Commission and the Miccosukee Tribe of Florida.

2. Define the immediate areas of influence for each of the respective land uses. Potential influences from internal land uses include:

   - increases in nutrient or bacteria contamination of waters from faulty septic systems and cattle grazing on non-Federal lands in the Preserve.
   - alterations to natural surface flow patterns due to ORV impacts to the soils and vegetation in the Preserve.
   - impacts to water quality due to Oil & Gas activities in the Preserve.

   Site specific water quality and/or quantity studies would be necessary to define the horizontal extent of influence from the various internal land uses. Field data and/or photogrammetry will be necessary to define the areas of influence for some of the land uses (i.e., ORV land use). It will be important for the Preserve to incorporate external monitoring sources (i.e., U.S. Geological Survey, South Florida Water Management District, etc.) to effectively evaluate areas of influence.

3. Digitize these boundaries and input into the Preserve's Geographic Information System database.

4. Prepare a report summarizing the status of internal land uses, trends, potential threats, and documented impacts to the Preserve's water resources.

Major elements to accomplish this project will include the hiring of a base-funded GS-9 scientist for two years during the initial project work. This temporary FTE would be complimented with the Preserve's existing staff (i.e., Hydrologist, Hydrological Technician, GIS Specialist, etc.) to provide the support necessary for accomplishing the project objectives. This project will compliment the efforts for project statements BICY-N-208, BICY-N-211, BICY-N-212, BICY-N-213, BICY-N-214, BICY-N-215, BICY-N-216, and BICY-N-217.

BUDGET AND FTEs:

----------FUNDED----------

	Source	Activity	Budget ($1000's)	FTEs
1995:				
1996:				
1997:				
1998:				
Total:			0.0	0.0

----------UNFUNDED----------

	Source	Activity	Budget ($1000's)	FTEs
1995:				
1996:	NPS	MON	20.0	0.5
	PKBASE-NR	MON	5.0	0.1
1997:	NPS	MON	20.0	0.5
	PKBASE-NR	MON	5.0	0.1
1998:	PKBASE-RES	MON	5.0	0.1
		Total:	55.0	1.3

Alternative Actions/Solutions and Impacts

No action. This alternative will restrict the evaluation of internal land use on the Preserve's water resources. The defined internal land use boundaries will be limited to the existing, and often dated, land use maps and databases.

Compliance codes: EXCL

Explanation: 516 DM2 App. 1.6

End of data

BICY-N-106.000
Priority: 11

Title: INVENTORY EXTERNAL LAND USE

Funding Status: Funded: 0.0 Unfunded: 80.0

Servicewide Issues : N11 (WATER QUAL-EXT)
N20 (BASELINE DATA)

Cultural Resource Type : C70, C73
RMAP Program codes : C03, Q01

Problem Statement

Land uses outside of the Preserve's boundary have the potential to affect the quality of waters and volume of waters entering the Preserve. Flow through Kissimmee Billy Strand, Mullet Slough and Okaloacoochee Slough to the north provide a conduit for external flows into the Preserve. Flows through canals (i.e., Barron River along the western boundary and L-28 Interceptor along the northeastern boundary) also provide access for external flows into the Preserve. The Preserve does not have a complete inventory of land uses immediately outside its boundaries which potentially could impact the Preserve's water resources. The primary external land uses immediately north (upgradient) of the Preserve are agriculture and Indian land use.

Lands north of the Preserve had received relatively little attention until the 1988 Addition legislation brought the Barron River Canal and a major part of Mullet Slough into the Preserve. Within the original Preserve boundary (581,700 acres), areas receiving direct external flows were minimal (< 10%). The Additions have increased these areas receiving external flows to approximately 150,000 acres (25%). These lands were added to the Preserve in recognition of the changing land use patterns upgradient and the potential impacts to the Everglades ecosystem.

An inventory of external land uses will provide a baseline for monitoring trends, making it possible to identify new sources of impacts to water quality and flows, and allowing the Preserve to become a more effective participant in regional planning. One of the primary external threats to the quality and/or quantity of waters within the Preserve's watershed is the southward progression of agriculture, along the northern boundary of the Preserve. Following the devastating freezes in the 1980's, there was a major shift in citrus production as growers, seeking to reduce the risk of freeze damage, moved southward into Hendry and Collier counties. Between 1980 and 1990, citrus acreage doubled to 150,000 acres (Mazzotti, et al., 1992) and is projected to reach 200,000 acres by the year 2000.

Land use practices by the Seminole and Miccosukee Tribes to the north may also impact the water resources of the Preserve. The Seminole Tribe, in response to its participation in the Everglades Restoration Project, has prepared a conceptual water management plan to meet both anticipated new water quality standards and its needs for internal economic activities. Included in this plan is restoration of surface flows from designated Water Resource Areas to the Additions of the Preserve through structures installed in the West Feeder Canal, an east-west canal north of the Preserve that intercepts the north-south regional water flows. The quality and quantity of waters flowing south into the Preserve and modification to existing land use activities will need to be closely monitored by the Preserve.

The 729,000 acre Preserve is a unique water-dependent ecosystem resulting from a combination of its climate and physiographic setting: the climate provides the hydrological input; the physiographic setting controls the distribution of the input. As much as 90 percent of the Preserve is inundated to depths ranging from a few inches to more than three feet during the wet season (May-October). During the dry season (November-April), water levels recede, reducing the areas inundated in the Preserve to approximately 10 percent. The ecology of the Preserve is finely tuned to the seasonal flow of water and any

interference can alter this sensitive habitat. As a result, the external land uses which might impact the water quality and/or water flows, should be identified and the respective areas of influence defined.

Description of Recommended Project or Activity

This project will require a detailed inventory from internal and external sources to identify the various land uses immediately outside the Preserve and define the approximate areas in influence of each respective land use. The primary objective of the project is to provide a more comprehensive inventory database of external land uses that will allow the Preserve to identify potential impacts before resource damage occurs, monitor land use trends and to effectively use regional planning to protect the resources of the Preserve. These data will be used in conjunction with water quality and flow data to identify their possible origins, and to evaluate the Preserve's water quality monitoring program.

The project will accomplish this objective as follows:

1. Identify the various land uses immediately outside the Preserve utilizing external and internal sources, such as county land status maps and satellite images. Also examine historic external land uses to better define trends and/or correlations between land uses and the associated impacts to the Preserve's water resources, if any.

2. Define the immediate areas of influence for each of the respective land uses. Potential influences from external land uses include:

   - increases in nutrient and/or metal concentrations from waters entering the northeastern portion of the Preserve due to surface water releases from the Seminole's Big Cypress Reservation.
   - increases in pesticide, nutrient and/or metal concentrations in Barron River Canal along the Preserve's western boundary from the agriculturally active lands immediately north of the Preserve.
   - unnatural decreases and increases in the quantity of water entering the Preserve due to seasonal water uses to the north of the Preserve. Typically water demands for growing crops in south Florida increase during the primary growing season (winter months) when regional rainfall is minimal. During the wet season, excess surface water may be pumped off the fields, increasing the quantity of waters entering the Preserve.

   Site specific water quality and/or quantity studies would be necessary to define the horizontal extent of influence from the various land uses. Field data and/or photogrammetry will be necessary to define the areas of influence for some of the land uses (i.e., agricultural land use). It will be important for the Preserve to incorporate external monitoring sources (i.e., U.S. Geological Survey, South Florida Water Management District, Seminole Tribe of Florida, etc.) to effectively evaluate areas of influence. There has been support from the South Florida Water Management District and Seminole Tribe of Florida to develop cooperative efforts for monitoring the regional water resources.

3. Digitize these boundaries and input into the Preserve's Geographic Information System database.

4. Include associated water quality, flows and stage data for the respective land uses, if available, into the Geographic Information System databases.

5. Prepare a report summarizing the status of land uses, trends, and potential and documented impacts to the Preserve.

Major elements to accomplish this project will include the hiring of a base-funded GS-9 scientist for two years (0.2 FTE/year) during the initial project work. This temporary FTE would be complimented with the Preserve's existing staff (i.e., Hydrologist, Hydrological Technician and GIS Specialist) to provide the necessary support to accomplish the objectives of this project. Management of the Preserve is committed to the necessary efforts for this project. This temporary FTE could support the personnel needs for project statements BICY-N-202 and BICY-N-209. As stated previously, additional support from external sources (i.e., U.S. Geological Survey, South Florida Water Management District, etc.) will be pursued to produce the most cost effective approach to the project.

Literature Cited

Mazzotti, F.J., L.A. Brandt, and Others, 1992. An Evaluation of the Regional Effects of New Citrus Development on the Ecological Integrity of Wildlife Resources in Southwest Florida: Final Report, South Florida Water Management District, West Palm Beach, Florida. 187 pp.

BUDGET AND FTEs:

----------FUNDED----------

	Source	Activity	Budget ($1000's)	FTEs
1995:				
1996:				
1997:				
1998:				
		Total:	0.0	0.0

----------UNFUNDED----------

	Source	Activity	Budget ($1000's)	FTEs
1995:				
1996:	NPS	MON	30.0	0.1
	PKBASE-NR	MON	10.0	0.2
1997:	NPS	MON	30.0	0.1
	PKBASE-NR	MON	5.0	0.2
1998:	PKBASE-RES	MON	5.0	0.1
		Total:	80.0	0.7

Alternative Actions/Solutions and Impacts

No action. This alternative will restrict the evaluation of external land use on the Preserve's water resources. The defined external land use boundaries will be limited to the existing, and often dated, land use maps and databases.

Compliance codes: EXCL

Explanation: 516 DM2 App. 1.6

End of data

BICY-N-200.000
Priority: 12

Title: SUPPORT THE SOUTH FLORIDA NATIONAL WATER QUALITY ASSESSMENT PROGRAM

Funding Status: Funded: 4.0 Unfunded: 3.0

Servicewide Issues : N11 (WATER QUAL-EXT)
N20 (BASELINE DATA)

Cultural Resource Type : N/A
RMAP Program codes : Q01

Problem Statement

Even though south Florida has been identified as one of the target basins for the U.S. Geological Survey National Water Quality Assessment (NAWQA) Programs, the involvement of Big Cypress National Preserve has been very limited. Active participation in the NAWQA program would benefit the Preserve by the possible establishment of additional monitoring sites, and the incorporation of the Preserve's water quality into the regional databases.

The major objectives of the NAWQA Program is to provide a consistent description of current water quality conditions for the Nation's water resources, to define long-term trends (or lack of trends) in water quality, and to identify, describe, and explain the major factors that effect water quality. The South Florida NAWQA Program began in 1993 in recognition of the importance of water quality to the entire south Florida ecosystem. The Preserve has provided limited field support in 1995 to assist the U.S. Geological Survey with the NAWQA program. The importance of the Preserve to the NAWQA Program is that the Big Cypress Swamp represents the least altered hydrologic system remaining in south Florida.

The Preserve can support the NAWQA program in several ways. The knowledge of the Preserve's Resource Management staff on local hydrologic conditions can assist in the identification of representative sample sites and the selection of appropriate parameters and sampling schedules. The Preserve can facilitate the installation of sampling equipment and transportation of personnel. Where it meets NAWQA standards, data collected by the Preserve can be added to the regional database.

The 729,000 acre Preserve is a unique water-dependent ecosystem resulting from a combination of its climate and physiographic setting: the climate provides the hydrological input; the physiographic setting controls the distribution of the input. As much as 90 percent of the Preserve is inundated to depths ranging from a few inches to more than three feet during the wet season (May-October). During the dry season (November-April), water levels recede, reducing the areas inundated in the Preserve to approximately 10 percent. The ecology of the Preserve is finely tuned to the seasonal flow of non-polluted water and any interference can alter this sensitive habitat. As a result, it is important to support regional efforts to assess the water quality in order to identify impacts to local and regional water quality. The NAWQA Program will provide an improved scientific basis for evaluating the effectiveness of water quality management programs and practices.

Description of Recommended Project or Activity

The objective of this project is to enhance water resource monitoring and the distribution of data from the Preserve by:

- providing a support role for the South Florida NAWQA Program.

- incorporating water quality data collected as part of the South Florida NAWQA Program into the Preserve's hydrology database.

The program will accomplish these objectives as follows:

1. Assist the U.S. Geological Survey with field activities (i.e., identifying the Preserve's existing water quality monitoring network and locating other potential field sampling sites) in the Preserve that will provide the initial planning direction for the Big Cypress Swamp and Everglades physiographic regions.

2. Participate in program planning decisions by attending the South Florida NAWQA liaison committee meetings which meet twice a year.

3. Assist the U.S. Geological Survey with collection of data from evapotranspiration monitoring sites.

4. Submit the Preserve's monthly water quality data to the U.S. Geological Survey.

5. Incorporate appropriate NAWQA data into the Preserve's hydrology database.

BUDGET AND FTEs:

----------FUNDED----------

	Source	Activity	Budget ($1000's)	FTEs
1995:	PK-BASE	MON	1.0	0.05
1996:	PK-BASE	MON	1.0	0.1
1997:	PK-BASE	MON	1.0	0.1
1998:	PK-BASE	MON	1.0	0.1
		Total:	4.0	0.35

----------UNFUNDED----------

	Source	Activity	Budget ($1000's)	FTEs
1995:				
1996:	PKBASE-NR	MON		
	NPS	MON	3.0	
1997:	PKBASE-NR	MON		
1998:	PKBASE-NR	MON		
		Total:	3.0	0.0

Alternative Actions/Solutions and Impacts

No action. This alternative would most likely impact the Preserve's professional relationship with the local county, state and Federal agencies. It is important for the Preserve to contribute to the management of south Florida's water resources. It should be noted that more than 50% of the Preserve's hydrology program is financially supported by external agencies.

Compliance codes: EXCL

Explanation: 516 DM2 App. 1.6

End of data

BICY-N-201.000
Priority: 13

Title: SUPPORT REGIONAL MERCURY CONTAMINATION ASSESSMENT

Funding Status: Funded: 1.0 Unfunded: 6.0

Servicewide Issues : N11 (WATER QUAL-EXT)
N20 (BASELINE DATA)
Cultural Resource Type : C70
RMAP Program codes : Q01

Problem Statement

The U.S. Environmental Protection Agency (EPA) is currently undertaking a study to address the problem of mercury throughout the Big Cypress and Everglades region. Mercury sampling efforts by the U.S. Geological Survey have also been initiated in 1995. The protection of Big Cypress National Preserve would be enhanced by actively supporting efforts to identify the source(s) and magnitude of mercury problems in south Florida. Past involvement by the Preserve has been very limited.

Mercury contamination has been detected in the water and fish collected from the Preserve. One water sample collected from the Preserve in 1988, exceeded the 1988 Florida Department of Environmental Regulations (currently Florida Department of Environmental Protection) limit of 0.2 µg/l for Class III waters, with a reported concentration of 0.6 µg/l (Weeks, 1989). Mercury concentrations exceeded the Food and Drug Administration's (FDA) recommended consumption level (1.0 mg/kg) in four of the five fish (largemouth bass) collected from the L-28 Canal along the Preserve's eastern boundary in 1989 (Hazleton Laboratories America, Inc., 1990). Although mercury was detected in all five largemouth bass collected from the L-28 Interceptor Canal --- located within the northeastern Additions --- in 1989, none exceeded 1.0 mg/kg. Mercury concentrations in three species of fish (largemouth bass, bowfin & gar) collected from the L-28 Canal in 1992 ranged from 0.7 mg/kg to 3.25 mg/kg (Florida Game and Freshwater Fish Commission, 1992).

A high concentration of mercury (110 mg/kg) was detected in the liver of a Florida Panther that died in the Everglades in 1989. No definitive cause of death was identified, but mercury toxicosis is suspected. Analysis of various tissue samples from other dead panthers recovered since 1978 also contain elevated mercury levels (Florida Panther Interagency Committee, 1989). Additional wildlife studies are on-going to further evaluate the extent of the mercury problem.

The 729,000 acre Preserve is a unique water-dependent ecosystem resulting from a combination of its climate and physiographic setting: the climate provides the hydrological input; the physiographic setting controls the distribution of the input. As much as 90 percent of the Preserve is inundated to depths ranging from a few inches to more than three feet during the wet season (May-October). During the dry season (November-April), water levels recede, reducing the areas inundated in the Preserve to approximately 10 percent. The ecology of the Preserve is finely tuned to the seasonal flow of clean water and any interference can alter this sensitive habitat. As a result, strong support of the regional efforts to study the mercury problem is necessary to assure that this water quality impact is properly addressed.

Description of Recommended Project or Activity

This project will require the Preserve to support the on-going efforts of the EPA and U.S. Geological Survey to study the mercury contamination problem in south Florida. The study objectives include further defining the extent of mercury contamination in various media, determining mercury sources, and performing ecological risk assessments.

The project will accomplish these objectives by providing the necessary support within the Preserve's boundary, as requested by the EPA and U.S. Geological Survey. This support includes providing field transportation, background information (i.e., water quality, water flows, etc.) and field sampling assistance. The Preserve will also need to keep internal documentation (i.e., computer database) of the collected mercury data to meet the resource management needs of the Preserve. The duration of this project is unknown at this time since the time frame for producing a comprehensive assessment of mercury contamination in south Florida is unknown. It will be important for all the appropriate state, Federal and county agencies to participate in a cooperative effort, on an as-needed basis, to provide the objectives of this regional assessment.

Literature Cited

Florida Game and Fresh Water Fish Commission, 1992. Summary of South Florida Fish Mercury Concentrations as of January 1992, March 19, 1992 Memorandum. (Station ID: C10).

Florida Panther Interagency Committee, 1989. Status Report Mercury Contamination in Florida Panthers. Florida Game and Fresh Water Fish Commission, Florida Department of Natural Resources, U.S. Fish and Wildlife Service and National Park Service Technical Subcommittee Report. 10 pp.

Hazleton Laboratories America, Inc., 1990. Analytical Reports for Mercury Concentrations in Fish Tissue (Sample ID's: BC90001 - BC90010), Catalog # 6148, Madison, WI.

Weeks, D.P., 1989. Big Cypress National Preserve Water Quality Report 1988. Unpubl., NPS, Big Cypress National Preserve, Ochopee, FL. 10 p.

BUDGET AND FTEs:

----------FUNDED----------

	Source	Activity	Budget ($1000's)	FTEs
1995:	PKBASE-NR	MON	1.0	
1996:	PKBASE-NR	MON		0.1
1997:	PKBASE-NR	MON		0.1
1998:	PKBASE-NR	MON		0.1
		Total:	1.0	0.3

----------UNFUNDED----------

	Source	Activity	Budget ($1000's)	FTEs
1995:				
1996:	PKBASE-NR	MON	2.0	
1997:	PKBASE-NR	MON	2.0	
1998:	PKBASE-NR	MON	2.0	
		Total:	6.0	0.0

Alternative Actions/Solutions and Impacts

No action. This alternative would most likely impact the Preserve's professional relationship with the local county, state and Federal agencies. It is important for the Preserve to contribute to the assessment and management of south Florida's water resources. It should be noted that more than 50% of the Preserve's hydrology program is financially supported by external agencies.

Compliance codes: EXCL

Explanation: 516 DM2 App. 1.6
516 DM6 App. 7.4 E(3)

End of data

BICY-N-202.000
Priority: 14

Title: SUPPORT AQUIFER CHARACTERIZATION STUDIES

Funding Status: Funded: 0.0 Unfunded: 16.0

Servicewide Issues : N12 (WATER FLOW)
N20 (BASELINE DATA)
Cultural Resource Type : C70
RMAP Program codes : Q01

Problem Statement

Big Cypress National Preserve does not have detailed hydrogeologic information characterizing the shallow and deep aquifers within the Preserve. Expanding ground water pumping to the west and north, raises concern that the water in the Preserve might soon be impacted, if it is not already. Studies proposed by the South Florida Water Management District and U.S. Geological Survey offer an opportunity to greatly expand our understanding of ground water in the Preserve.

There are two major limestone aquifer systems underlying the Preserve, the Shallow Aquifer (Chokoloskee Aquifer) and the much deeper Floridan Aquifer. The Shallow Aquifer begins at the surface and has a maximum thickness of approximately 130 feet in western Collier County; reducing in thickness to 60-85 feet in the central and southern portions of the Preserve, before thinning out along the eastern Preserve boundary (Klein, 1972) (Duever et al., 1986). The Shallow Aquifer is the most productive aquifer in Collier County and is primarily recharged by local precipitation. This surficial aquifer is the major source of ground water for human use in southwest Florida. The Floridan Aquifer begins approximately 400 feet below ground surface in the Preserve. This relatively deep aquifer is a predominate source of potable water north of Lake Okeechobee. The Floridan Aquifer is highly mineralized beneath the Preserve, thus limiting most uses, but can be treated by reverse osmosis filtration for potable use. The thickness of the Floridan Aquifer is not well defined in south Florida.

The Shallow Aquifer is nonartesian and contains beds and lenses of almost impermeable sandy clays and fine sands, which locally retard circulation within the aquifer (McCoy, 1962). The coefficient of transmissibility of the aquifer varies as much as 500 percent or more over short distances (Parker et al., 1955). It will be important for the Preserve to better understand the interaction between surface and ground water in south Florida in order to adequately assess local flow characteristics. Aquifer tests will provide the information necessary to better understand these hydrological characteristics, including transmissivity, permeability and water quality. This data will improve hydrologic models that describe water flow through Big Cypress National Preserve and Everglades National Park.

The South Florida Water Management District has been involved in a ground water resource assessment of the Floridan Aquifer system. The main purpose of this study is to determine the availability and quality of ground water from the Floridan Aquifer throughout Hendry, Lee and Collier counties. The information obtained from this study will be incorporated into a three-dimensional ground water flow model.

The South Florida Water Management District and U.S. Geological Survey currently monitor the quality and stage of ground water within the saturated zones above the Floridan Aquifer. Only one monitor well (U.S. Geological Survey, ID = C 495) is currently located within the Preserve's boundary and only ground water elevations are recorded at this monitoring well. The U.S. Geological Survey will be conducting studies, starting in 1996, to quantify historic changes in water levels and water chemistry (nutrients and salinity) by examining shallow cores (< 2 meters) from Florida Bay, Everglades National Park, Big Cypress National Preserve and the Water Conservation Areas. Approximately ten cores within the Shallow Aquifer are proposed for the Preserve in 1997. The Preserve should compliment this effort by establishing ground water monitoring sites

utilizing some of the core boreholes for installation of monitoring wells. The work involved with establishing ground water monitoring sites would be included in project statement BICY-N-033.000.

The U.S. Geological Survey's Eastern Regional Geologic Mapping Team has been funded by the South Florida Ecosystem Program to study the geologic framework of the Shallow Aquifer system in south Florida, including the Preserve. Approximately 40 borings will be drilled to the base of the surficial aquifer system in Collier and Monroe counties. Drilling, permeability testing, and lithologic logging will be provided by the Florida Geological Survey, and should be accomplished within three years (FY 96-98).

The 729,000 acre Preserve is a unique water-dependent ecosystem resulting from a combination of its climate and physiographic setting: the climate provides the hydrological input; the physiographic setting controls the distribution of the input. As much as 90 percent of the Preserve is inundated to depths ranging from a few inches to more than three feet during the wet season (May-October). During the dry season (November-April), water levels recede, reducing the areas inundated in the Preserve to approximately 10 percent. The ecology of the Preserve is finely tuned to the seasonal flow of unpolluted water and any interference can alter this sensitive habitat. As a result, it is important to adequately characterize the ground water beneath the Preserve to better understand the dynamics of the water resources and to support the regional efforts to better define future potable water sources.

Description of Recommended Project or Activity

Provide field assistance to the South Florida Water Management District and U.S. Geological Survey for installation of ground water monitoring sites within the Preserve's watersheds. Incorporate the ground water monitoring data into the Preserve's hydrology database.

The objectives of this project are to:

- Increase understanding of the status and characteristics of the Shallow and Floridian Aquifers in the Preserve.
- Improve the Preserve's ability to assess the impacts of current ground water pumping and predict the impacts of new pumping in the region.

This will be accomplished primarily by assisting the South Florida Water Management District and U.S. Geological Survey in establishing a ground water monitoring network within the Preserve's watersheds. Specific actions to accomplish these objectives include the following:

1. Assist the South Florida Water Management District and U.S. Geological Survey with field activities for drilling soil borings and installing ground water monitoring sites within the Preserve's watersheds to characterize and monitor the Shallow and Floridan Aquifer systems. Assistance by the Preserve will include preparation of site specific environmental assessments and surface use agreements, providing some field transportation, and assistance in locating soil boring and ground water monitoring sites.

2. Obtain existing (historical) ground water monitoring data from various external sources (see project statement BICY-N-100.000). The ground water data should not be restricted to the Preserve's boundaries but include the entire watersheds of the Preserve.

3. Prepare appropriate geologic and ground water data (i.e., transmissivity, storativity, water quality, etc.) into a compatible database format for the Preserve's hydrology program.

Major elements to accomplish this project will include the hiring of a base-funded GS-9 hydrologist for three years (0.2 FTE/year) during the field work proposed by the South Florida Water Management District and U.S. Geological Survey. The

temporary FTE would compliment the Preserve's existing staff (i.e., Hydrologist, Hydrological Technician, GIS Specialist) to provide the necessary support to accomplish the objectives of this project. Management of the Preserve is committed to the necessary efforts for this project. This GS-9 FTE could also support the personnel needs for project statements BICY-N-106 and BICY-N-209.

Literature Cited

Duever, J.D., J.D. Carlson, J.F. Meeder, L.C. Duever, L.H. Gunderson, L.A. Riopelle, T.R. Alexander, R.L. Meyers, and D.P. Spangler, 1986. The Big Cypress National Preserve. Research Report No. 8 of the National Audubon Society, New York. 38-40 p.

Klein, H., 1972. The Shallow Aquifer of Southwest Florida. Florida Dept. Of Natural Resources, Bureau of Geol., Map Series 53, Tallahassee, FL.

McCoy, H.J., 1962. Ground Water Resources of Collier County, Florida. Florida Geol. Survey Rep. Invest. No. 31. 82 pp.

Parker, G.G., G.E. Ferguson, S.K. Love, and others, 1955. Water Resources of Southeastern Florida. U.S. Geol. Survey Water Supply Pap. 1255. 965 pp.

BUDGET AND FTEs:

----------FUNDED----------

	Source	Activity	Budget ($1000's)	FTEs
1995:				
1996:				
1997:				
1998:				
		Total:	0.0	0.0

----------UNFUNDED----------

	Source	Activity	Budget ($1000's)	FTEs
1995:				
1996:	PKBASE-NR	RES	3.0	0.2
	NPS	RES	3.0	
1997:	PKBASE-NR	MON	5.0	0.2
1998:	PKBASE-NR	MON	5.0	0.2
		Total:	16.0	0.6

BICY-N-202.000
Priority: 14

Alternative Actions/Solutions and Impacts

No action. This alternative would impede cooperative efforts with the South Florida Water Management District and the U.S. Geological Survey and limit the production of important ground water information. It is important for the Preserve to contribute to the management of south Florida's water resources. It should be noted that more than 50% of the Preserve's hydrology program is financially supported by external agencies.

Compliance codes: EA

Explanation: 516 DM2 App. 2, 2.10

End of data

Title: SUPPORT EVAPOTRANSPIRATION MONITORING EFFORTS

Funding Status: Funded: 1.0 Unfunded: 40.0

Servicewide Issues : N20 (BASELINE DATA)

Cultural Resource Type : N/A
RMAP Program codes : Q01

Problem Statement

Big Cypress National Preserve does not collect evapotranspiration (ET) data in the Preserve for water budget analyses. The U.S. Geological Survey has expressed an interest, in 1995, to install and maintain an ET monitoring station in the Preserve. ET, or the sum of evaporation plus transpiration (the process by which plants give off water vapor through their leaves), can be included with other components of the Preserve's hydrological equation (i.e., precipitation, infiltration, storativity, water deliveries, etc.) to better define its water budget. The hydrological equation provides a quantitative means of evaluating the hydrologic cycle. This fundamental equation is a simple statement of the **law of mass conservation**, which is expressed as:

Inflow = Outflow +/- Changes in Storage.

The 729,000 acre Preserve is a unique water-dependent ecosystem resulting from a combination of its climate and physiographic setting: the climate provides the hydrological input; the physiographic setting controls the distribution of the input. As much as 90 percent of the Preserve is inundated to depths ranging from a few inches to more than three feet during the wet season (May-October). During the dry season (November-April), water levels recede, reducing the areas inundated in the Preserve to approximately 10 percent. The ecology of the Preserve is finely tuned to the seasonal flow of unpolluted water and any interference can alter this sensitive habitat. As a result, it is important to record ET data to better understand the water budget dynamics of the Preserve.

Similar to precipitation, ET is variable at different locations within the Preserve. The variability is produced by the several factors which influence ET including, air temperature, humidity, vegetation type, wind speed/duration, and sunlight exposure (Fetter, 1980). It will be important for the Preserve to support the development of an ET monitoring network within the Preserve's watershed in order to monitor the range of ET variability in the area.

Efforts to better understand the Preserve's hydrological equation have already been initiated. The Preserve maintains seven weather monitoring stations which continuously measure precipitation. Some of these weather stations also record air temperature, wind speed and humidity. The U.S. Geological Survey monitors discharge through all the bridges along U.S. Highway 41, while the National Park Service and South Florida Water Management District monitor water stages at remote locations within the Preserve.

Description of Recommended Project or Activity

Provide field assistance to the U.S. Geological Survey for installation of ET monitoring sites within the Preserve's watersheds. Incorporate the ET data into the Preserve's hydrology database. The objective of this project is to develop some understanding of the ET rates and variability in the Preserve.

The program will accomplish this objective as follows:

1. Assist the U.S. Geological Survey with field activities for the installation of ET monitoring sites within the Preserve's watersheds. This will include providing helicopter transportation of the building materials for the station platform and associated ET monitoring equipment to the selected locations. Some of the materials transported by the helicopter will require external loading (sling load), which requires trained personnel (Preserve Fire Management personnel) working hazardous duty hours. Unit cost for the helicopter is approximately $350 per hour.

2. Assist the U.S. Geological Survey with collection of data from ET monitoring sites. This will also require some helicopter transportation (approximately $350/hr).

3. Obtain existing (historical) ET data from various external sources. The ET data should not be restricted to the Preserve's boundaries but include the entire watersheds of the Preserve.

4. Prepare the ET data into a compatible database format for the hydrology program and input data into the Preserve's hydrology database.

5. Develop procedures for the electronic transfer of future ET data from appropriate external sources on a scheduled frequency.

A major element to accomplish this project will include a base increase for an FTE (GS-7, Hydrologic Technician) to assist in collection of ET field data. This FTE would also meet the personnel needs for project statement BICY-N-033.

Literature Cited

Fetter, Jr., C.W., 1980. Applied Hydrology. Charles Merrill Publ. Co., Columbus, Ohio. 18-20 pp.

BUDGET AND FTEs:

	Source	Activity	Budget ($1000's)	FTEs
	----------FUNDED----------			
1995:	PKBASE-NR	RES	1.0	
1996:				
1997:				
1998:				
		Total:	1.0	0.0

----------UNFUNDED----------

	Source	Activity	Budget ($1000's)	FTEs
1995:				
1996:	PKBASE-NR	RES	5.0	0.1
	FED-OTHER	MON	10.0	0.1
	NPS	RES	5.0	
1997:	PKBASE-NR	MON	5.0	0.1
	NPS	MON	5.0	0.1
1998:	PKBASE-NR	MON	5.0	0.1
	NPS	MON	5.0	0.1
		Total:	40.0	0.6

Alternative Actions/Solutions and Impacts

No action. This alternative would involve not actively supporting cooperative efforts with the U.S. Geological Survey, thus limiting efforts to collect ET data and our understanding of the hydrologic process. It is important for the Preserve to contribute to the management of south Florida's water resources. It should be noted that more than 50% of the Preserve's hydrology program is financially supported by external agencies.

Compliance codes: EXCL

Explanation: 516 DM2 App. 1.6
516 DM6 App. 7.4 E(3)

End of data

BICY-N-204.000
Priority: 16

Title: SUPPORT EFFORTS TO ASSESS AND MITIGATE IMPACTS FROM L-28 INTERCEPTOR AND L-28 LEVEE SYSTEMS ON WATER RESOURCES

Funding Status: Funded: 2.0 Unfunded: 825.0

Servicewide Issues : N11 (WATER QUAL-EXT)
N12 (WATER FLOW)
Cultural Resource Type : C56, C70
RMAP Program codes : Q01

Problem Statement

The L-28 Interceptor and L-28 Levee systems, located along the Preserve's northeastern and eastern boundaries, respectively, alter the natural flow of surface water in the Preserve. They were constructed in the 1960's by the U.S. Army Corps of Engineers. The L-28 Levee system was constructed to confine the Everglades water flows to Water Conservation Area 3A and to subsequently lower the water level to the west including the Dade-Collier Transition and Training Airport, which occupies a 32-square-mile site adjacent to the eastern boundary of the Preserve. The southern end of the L-28 Interceptor system is used to route water into Water Conservation Area 3A. Gaining a more quantitative understanding of the impacts of these levees and canals is necessary so that their impacts can be brought to the attention of the appropriate water management entities and effectively mitigated.

Due to the general north-south orientation of the L-28 Interceptor canal, waters impacted from the various land-uses (i.e., agriculture) to the north in Hendry County, rapidly drain through the canal and into the Preserve before terminating into the Water Conservation Area (WCA) 3A, immediately east of the Preserve. Hendry County is one of the fastest growing agricultural counties in Florida, with citrus rapidly becoming the dominant crop. The waters from WCA 3A eventually flow into Everglades National Park and Big Cypress National Preserve through the S-343A, S-343B, S-344, S-12 and S-14 water control structures. Waters from the Mullet Slough system flow into the Preserve through three breaches in the L-28 Tieback levee.

The Seminole Tribe has prepared a Water Management Plan in 1995 which defines a proposed water conservation system design for the Big Cypress Reservation (AMS Engineering and Environmental, 1995). This reservation is located along the Preserve's northern boundary. The proposed design includes the discharge of surface water across the West Feeder Canal and into the Preserve's watershed. Currently, the West Feeder Canal interrupts the natural north-south flow of water into the Preserve and drains east into the L-28 Interceptor Canal. If the plan is implemented, the quality of the waters which are discharged into the Preserve will need to be closely monitored since these waters will have drained from the agriculturally active lands located on the reservation. The plan includes sampling of the waters by the Seminole Tribe prior to discharging across the West Feeder Canal.

The L-28 Levee system, which consists of a levee and canal, extends northward from the Tamiami Trail and forms the eastern boundary between the Big Cypress Swamp and Everglades drainage. The levee impedes the natural flow of waters draining from Kissimmee Billy Strand and Mullet Slough, located in the Preserve's northeastern additions. The L-28 Levee system is approximately 12 miles long (L-28 Levee) with a 2-mile tieback (L-28 Tieback) extending westward at the northern end. The borrow canal along the upper five miles of the L-28 Levee is located on the east side of the levee; for the remainder of the levee, it is located on the west side. There is a regulated culvert (S-344) at this changeover location where water can be released in either direction between the Big Cypress Swamp and the Everglades drainages.

In response to the hydrological impacts from the L-28 Levee system, the U.S. Army Corps of Engineers cut three openings into the L-28 Tieback levee to allow waters from the north to flow through the east-west tieback, and installed ten earthen plugs in the north-south borrow canal to inhibit the rapid drainage of waters in the area. This modification in the L-28 Levee system has been ineffective in promoting adequate transfers of water between Big Cypress Swamp and the Everglades (Schneider and Flora, 1986).

The 729,000 acre Preserve is a unique water-dependent ecosystem. As much as 90 percent of the Preserve is inundated to depths ranging from a few inches to more than three feet during the wet season (May-October). During the dry season (November-April), water levels recede, reducing the areas inundated to approximately 10 percent. The ecology of the Preserve is finely tuned to the seasonal flow of unpolluted water and any interference can alter this sensitive habitat. The L-28 Interceptor and L-28 Levee system (levee and borrow canal) create an unnatural hydrological barrier between the Preserve and Everglades National Park drainages. As a result, it is important to support efforts to fully assess hydrological impacts from the L-28 Interceptor and L-28 Levee systems, and to incorporate proper mitigation efforts to restore the natural flow regimen without sacrificing the excellent water quality of the Preserve.

Description of Recommended Project or Activity

The Preserve's objective of this project is to support the efforts of the U.S. Army Corps of Engineers and the South Florida Water Management District to effectively mitigate the impacts from the L-28 Interceptor and L-28 Levee systems.

The project will accomplish this objective as follows:

1. Provide the U.S. Army Corps of Engineers and South Florida Water Management District with all available information regarding the L-28 Interceptor and L-28 Levee systems. This will include an inventory (i.e., size and location) of all water control structures (i.e., bridges, culverts, canal plugs, etc.) which influence the eastern water deliveries.

2. Work with the U.S. Army Corps of Engineers, South Florida Water Management District, Monroe County, Florida Department of Transportation and Everglades National Park to determine locations for installing additional conduits (bridges & culverts) through roadways (i.e., Tamiami Trail, Loop Road) to effectively transfer waters through the elevated foundation of the roadways.

3. Review the water quality data from WCA 3A and evaluate problems, if any, associated with the increase in water deliveries to the Preserve and the water quality of these waters. If the Preserve increased the fresh water deliveries with waters of relatively poor quality, then the objective would not be met.

4. Prior to and after the U.S. Army Corps of Engineers has completed the appropriate modifications to the canal and levee systems, the Preserve will need to monitor the water quality and quantity within the areas of influence. For example, record GPS locations along Loop Road where inundation of the roadway continues to occur. Temporary water quality monitoring stations along Loop Road and Tamiami Trail may be established to monitor the initial progress of the project. After evaluation of the data, recommendations should be prepared to fine-tune the mitigation.

5. Monitor the water deliveries from the Seminole Big Cypress Reservation along the Preserve's northern boundary. This will require the installation of two permanent water quality monitoring stations in the northeastern Additions of the Preserve.

Major elements to accomplish this project will include the hiring of a base-funded GS-9 hydrologist for three years during the initial project work. This temporary FTE would be complimented with the Preserve's existing staff (i.e., Hydrologist,

Hydrological Technician) to provide the necessary support to accomplish the objectives of this project. This temporary FTE could also support the personnel needs for project statement BICY-N-205. Management of the Preserve is committed to the necessary efforts for this project, and anticipates that the priority will increase in the near future. The U. S. Army Corps of Engineers has initiated a study to evaluate the natural resource impacts of the L-28 and L-28 Tieback canals and levees. The unfunded budget proposed in this project statement includes part of this potential funding source under FED-OTHER (i.e., U.S. Army Corps of Engineers, South Florida Water Management District, U.S. Geological Survey).

Literature Cited

Schneider, W.J., and M.D. Flora, 1986 (unpubl). Hydrologic Assessment of the Big Cypress National Preserve: A Water Resources Analysis for the General Management Plan (GMP) and Minerals Management Plan (MMP). N.P.S., Colorado State University, Ft. Collins, CO. 36-37 p.

AMS Engineering and Environmental, 1995 (unpubl). Seminole Tribe of Florida, Conceptual Water Conservation System Design. Punta Gorda, FL. 74 pp.

BUDGET AND FTEs:

----------FUNDED----------

	Source	Activity	Budget ($1000's)	FTEs
1995:			2.0	0.1
1996:				
1997:				
1998:				
		Total:	2.0	0.1

----------UNFUNDED----------

	Source	Activity	Budget ($1000's)	FTEs
1995:				
1996:	PKBASE-NR	RES	5.0	0.1
	ST-LOCAL	RES	20.0	0.3
	FED-OTHER	RES	20.0	0.3
1997:	PKBASE-NR	MIT	10.0	0.2
	ST-LOCAL	MIT	50.0	0.3
	FED-OTHER	RES/MIT	200.0	3.0
1998:	PKBASE-NR	MON	20.0	0.2
	FED-OTHER	RES/MIT	500.0	4.0
		Total:	825.0	8.4

Alternative Actions/Solutions and Impacts

No action. This alternative would impede cooperative efforts between the Preserve and the U.S. Army Corps of Engineers, South Florida Water Management District and Monroe County while also limiting input for the Preserve's management objectives to the mitigation design. It is important for the Preserve to contribute to the management of south Florida's water resources. It should be noted that more than 50% of the Preserve's hydrology program is financially supported by external agencies.

Compliance codes: EA

Explanation: 516 DM2 App. 2,2.10

End of data

BICY-N-205.000
Priority: 17

Title: SUPPORT EFFORTS TO ASSESS AND MITIGATE IMPACTS FROM LOOP ROAD ON WATER RESOURCES

Funding Status: Funded: 207.0 Unfunded: 260.0

Servicewide Issues : N12 (WATER FLOW)

Cultural Resource Type : C57, C70
RMAP Program codes : Q01

Problem Statement

Loop Road (County Route 94) impedes the sheetflow of several significant cypress strands including; Robert's Lake Strand, Gator Hook Strand, Sweetwater Strand, Dayhoff Slough and several smaller stand systems. The existing bridges and culverts along Loop Road are inadequate for transmitting surface water southward across the roadway. This is evident from the 0.5 ft. difference in surface water elevation, observed in 1995, between the north and south side of Loop Road where the South Florida Water Management District monitors water stage in the borrow canal along the road. As a result, flooding is common along Loop Road. Mitigation of the L-28 levee and canal system currently proposed by the U.S. Army Corps of Engineers will increase the existing freshwater flows along Loop Road and thus increase the potential for flooding of the roadway.

The 729,000 acre Preserve is a unique water-dependent ecosystem. As much as 90 percent of the Preserve is inundated to depths ranging from a few inches to more than three feet during the wet season (May-October). During the dry season (November-April), water levels recede, reducing the areas inundated to approximately 10 percent. The ecology of the Preserve is finely tuned to the seasonal flow of unpolluted water and any interference can alter this sensitive habitat. As designated in the Preserve's General Management Plan (1992), cypress strands/sloughs are important resource areas. These cypress strands serve as the major corridors of water flow in the Preserve and ultimately into Everglades National Park. These strands also contain numerous rare and protected plants, including bromeliads, orchids, ferns and rare trees. The interruption of flow in cypress strands could have widespread adverse impacts to both the Preserve and Everglades National Park. A study by Duever et al. (1986) documented faster growth rates on the north side of roadways in the Preserve and a decreased growth rate on the south side of roadways where sheetflow is restricted. As a result, it will be important to support efforts to fully assess and mitigate the hydrological impacts from Loop Road.

Description of Recommended Project or Activity

The Preserve's objective is to enhance the natural flow of surface water under Loop Road. The National Park Service should support the on-going efforts by Monroe County and the U.S. Army Corps of Engineers to effectively locate and install conduits (bridges, culverts) across Loop Road.

The project will accomplish this objective as follows:

1. Inventory (i.e., location, size) the existing culverts and bridges located along Loop Road and input into the Preserve's Geographic Information System.

2. Work with the appropriate county (Monroe, Dade, Collier) to have damaged culverts repaired or replaced.

3. Locate areas where inundation of Loop Road occurs and input into the Preserve's Geographic Information System.

4. Evaluate the following data to determine locations for additional culverts along Loop Road:

   - existing bridge and culvert locations
   - locations of seasonal flooding of Loop Road
   - Geographic Information System vegetation map for the Loop Road area.

5. Enter into a Memorandum of Understanding (MOU) or similar instrument, with the appropriate county (Monroe, Dade, Collier) agency to install the additional culverts. Install additional culverts at the predetermined locations.

6. Input all new culvert location and size data into the existing Geographic Information System database.

7. Monitor the effectiveness of the culverting project (i.e., define areas which continue to flood, if any) during the wet season.

8. Prepare proposal for a Phase II culverting project to address any continuous inundation problems.

9. Provide progress summaries to the appropriate state and Federal agencies (i.e., U.S. Army Corps of Engineers, South Florida Water Management District, Everglades National Park).

Major elements to accomplish this project will include the hiring of a NPS base-funded GS-9 hydrologist for 3 years during Phase II of this project. This temporary FTE would be complimented with the Preserve's existing staff (i.e., Hydrologist, Hydrological Technician). This FTE could also support the personnel needs of project statement BICY-N-204. The primary funding source for this project will be external (i.e., U.S. Army Corps of Engineers, South Florida Water Management District, Monroe County, Collier County).

Literature Cited

Duever, M.J., J.E. Carlson, J.F. Meeder, L.C. Duever, L.H. Gunderson, L.A. Riopelle, T.R. Alexander, R.F. Myers, and D.P. Spangler, 1986. The Big Cypress National Preserve. Research Report No. 8 of the National Audubon Society. 444 pp.

National Park Service, 1992. General Management Plan and Final Environmental Impact Statement, Big Cypress National Preserve, Florida. 423 pp.

BUDGET AND FTEs:

----------FUNDED----------

	Source	Activity	Budget ($1000's)	FTEs
1995:	PKBASE-NR	MIT		0.1
	ST-LOCAL	MIT	180.0	3.0
	NPS	MIT	7.0	
1996:	NPS	MIT	20.0	
1997:				
1998:				
		Total:	207.0	3.1

----------UNFUNDED----------

	Source	Activity	Budget ($1000's)	FTEs
1995:				
1996:	PKBASE-NR	MIT		0.1
	NPS	MIT	30.0	
	ST-LOCAL or FED-OTHER	MIT	100.0	2.0
1997:	PKBASE-NR	MON	5.0	0.1
1998:	PKBASE-NR	MIT	5.0	0.1
	NPS	MIT	20.0	
	ST-LOCAL or FED-OTHER	MIT	100.0	2.0
		Total:	260.0	4.3

Alternative Actions/Solutions and Impacts

No action. This alternative would impede the established cooperative efforts between the Preserve and Monroe County while also limiting input for the Preserve's management objectives to the mitigation design. Monroe County has already invested $180,000 in the project during 1995. It is important for the Preserve to compliment these efforts in a supportive role.

Compliance codes: EXCL

Explanation : 516 DM2 App. 1.6
516 DM6 App. 7.4 E(3)

End of data

BICY-N-206.000
Priority: 18

Title: SUPPORT EFFORTS TO ASSESS AND MITIGATE IMPACTS FROM BARRON RIVER CANAL ON WATER RESOURCES

Funding Status: Funded: 8.0 Unfunded: 140.0

Servicewide Issues : N11 (WATER QUAL-EXT)
N12 (WATER FLOW)
N20 (BASELINE DATA)

Cultural Resource Type : C56, C70
RMAP Program codes : Q01

Problem Statement

The Barron River Canal rapidly drains waters from agriculturally active areas to the north, traveling through the Preserve's western Addition lands along State Route 29 before terminating into the estuaries of Everglades City. A recent report prepared by Collier County Environmental Services Division in 1994, summarized the sediment quality throughout the county's inland system from 1989 to 1991. According to this report, a d-BHC (benzene hexachloride pesticide) concentration of 99 micrograms/kilogram (µg/kg) recorded from the north Barron River Canal, was the highest reported by Shahane (1994) for the state of Florida. It is evident that the potential impacts from canal systems to the Preserve's water resources consist of excessive drainage rates and introduction of poor water quality.

The Big Cypress Basin of the South Florida Water Management District currently maintains the canal (i.e., regulates flows) by agreement with Collier County. In December, 1996, the Preserve will take ownership of the canal following the implementation of the Arizona-Florida Land Exchange Act. Eight stop-log weirs on the canal (SR29-1...SR29-8) are presently in poor condition and these water control structures need maintenance and upgrading.

The 729,000 acre Preserve is a unique water-dependent ecosystem. As much as 90 percent of the Preserve is inundated to depths ranging from a few inches to more than three feet during the wet season (May-October). During the dry season (November-April), water levels recede, reducing the areas inundated to approximately 10 percent. The ecology of the Preserve is finely tuned to the seasonal flow of unpolluted water and any interference can alter this sensitive habitat. As a result, it will be important to support efforts to fully assess and mitigate the hydrological impacts associated with the Barron River Canal.

Description of Recommended Project or Activity

The Preserve's objective is to replicate the natural flow of surface water along the Barron River Canal, while maintaining good water quality from the Preserve's northern boundary to the estuaries in Everglades City. The Preserve will need to support the on-going efforts by the Florida Department of Transportation and South Florida Water Management District to effectively mitigate the rapid drainage of water along the canal system.

The Florida Department of Transportation has been working with the South Florida Water Management District in 1995 to prepare a water control structure design for the Barron River Canal between Interstate 75 and U.S. Highway 41. The proposal currently includes the installation of two control structures (3 - 60" diameter pipes with control valves) in the canal. Approximately 100 feet north of these control structures, three 24" diameter concrete reinforced pipes are proposed to allow water to flow from the canal to the west side of State Route 29 and into the Fakahatchee Strand wetlands system. The Preserve has reviewed the proposed design prepared by the South Florida Water Management District.

The project will accomplish this mitigation objective as follows:

1. Support the current efforts of the Florida Department of Transportation and South Florida Water Management District to install new water control structures in the Barron River Canal. Participate in planning and design efforts by these agencies to ensure the Preserve's interests are adequately considered.

2. Inventory (i.e., location and size) all new and existing water control structures and input into the Preserve's Geographic Information System.

3. Establish a permanent water quality station in the canal along the northern border of the Preserve and incorporate into the Preserve's existing monitoring network.

4. Develop a proposal to address the water quality and /or sediment contamination associated with the Barron River Canal system.

Fakahatchee Strand State Preserve, Everglades National Park and the Preserve support actions that restore natural flow conditions which are impacted by the Barron River Canal. The flow volume and timing required to accomplish these natural flow conditions may not meet the expectations of Immokalee and/or Everglades City over discharge retention and releases in the canal.

A major element to accomplish this project will include base funding a GS-7 FTE (Hydrological Technician) to accommodate the expanded water quality/quantity monitoring requirements. This FTE would also support the personnel needs defined in project statement BICY-N-033.000.

Literature Cited

Collier County Environmental Services Division, 1994. Sediment Quality in Inland Waterways of Collier County, 1989-1991. Publication Services Division, Publication Series, PC-AR-94-03. Collier County Pollution Control Dept., Naples, FL.

Shahane, A.N., 1994. Pesticide Detections in Surface Waters of Florida. A.R. Dutton (Ed.). Toxic Substances and the Hydrologic Sciences. American Inst. Hydrology. Minneapolis, MN. 408-416 pp.

BUDGET AND FTEs:

----------FUNDED----------

	Source	Activity	Budget ($1000's)	FTEs
1995:	ST-LOCAL	RES	8.0	0.1
1996:				
1997:				
1998:				
		Total:	8.0	0.1

----------UNFUNDED----------

	Source	Activity	Budget ($1000's)	FTEs
1995:				
1996:	PKBASE-NR	RES	10.0	0.1
	ST-LOCAL	MIT	100.0	2.0
	NPS	MON	20.0	
1997:	PKBASE-NR	MON	5.0	0.1
1998:	PKBASE-NR	MON	5.0	0.1
		Total:	140.0	2.3

Alternative Actions/Solutions and Impacts

No action. This alternative would impede cooperative efforts between the Florida Department of Transportation and South Florida Water Management District while also limiting input for the Preserve's management objectives to the mitigation design. It is important for the Preserve to contribute to the management of south Florida's water resources. It should be noted that more than 50% of the Preserve's hydrology program is financially supported by external agencies.

Compliance codes: EA

Explanation: 516 DM2 App. 2, 2.10

End of data

BICY-N-207.000
Priority: 19

Title: EVALUATE AND PURSUE OUTSTANDING NATIONAL RESOURCE WATERS DESIGNATION FOR THE PRESERVE

Funding Status: Funded: 0.0 Unfunded: 30.0

Servicewide Issues : N13 (WATER RIGHTS)

Cultural Resource Type : N/A
RMAP Program codes : Q01, Q02

Problem Statement

The waters of Big Cypress National Preserve are currently designated as Outstanding Florida Waters (OFW) by the state of Florida. Upgrading this to Outstanding National Resource Waters (ONRW), the most stringent designation available under the Clean Water Act and Florida Statutes, would provide an additional level of protection for the threatened waters of the Preserve.

While both OFW and ONRW are non-degradation standards, they differ in that ONRW provides for fewer exceptions under which permits can be granted, is more difficult to change, and provides for a longer baseline period. These non-degradation standards differ from typical water quality standards, in that the latter permits discharge of wastewater that may degrade water quality, so long as the water quality remains adequate to protect the various uses that have been designated for that water. A non-degradation standard is much better suited to protect the very high quality waters that currently exist in the Preserve. While an OFW designation can be granted administratively by the Florida Department of Environmental Protection, an ONRW designation requires action by the state legislature. Similarly, an OFW designation can be reclassified, or have exemptions and variances granted through administrative procedures, while under an ONRW designation these can only be accomplished through legislative action. A one year period is prescribed to determine baseline water quality conditions under OFW, while ONRW prescribes a five year baseline period.

The process for achieving an ONRW designation in Florida is presented in Section 62-302.700 of the Florida Administrative Code. It involves five steps, beginning with submission of a formal request for redesignation to the Florida Department of Environmental Protection. The Department then conducts a series of workshops seeking public and agency input regarding the proposal, conducts an economic impact analysis, and explores a finding that the waters are of exceptional recreational or ecological significance and that the environmental economic and social costs outweigh the benefits. In addition, the Department must find that the waters are such exceptional significance that they should be protected from all degradation; that a designation of ONRW is clearly necessary to protect their significance; and that the benefits outweigh the costs. The legislature may act on a recommendation by the Department to designate the ONRW, its legal boundaries, and baseline date.

The 729,000 acre Preserve is a unique water-dependent ecosystem. As much as 90 percent of the Preserve is inundated to depths ranging from a few inches to more than three feet during the wet season (May-October). During the dry season (November-April), water levels recede, reducing the areas inundated to approximately 10 percent. The wetlands ecology of the Preserve is finely tuned to the seasonal flow of unpolluted water and any interference can alter this sensitive habitat. Recognizing this, congress established that the primary purpose for the Preserve is, "...to assure the preservation, conservation, and protection of the natural, scenic, hydrologic, flora and faunal, and recreation values of the Big Cypress Watershed". With very few exceptions, water quality in the Preserve is very high and represents natural conditions more closely than any other waters in south Florida. Water quality in the Preserve is very vulnerable to degradation from internal and external contaminates, simply because it has such high water quality that small amounts of contaminates can result in relatively large degradation.

BICY-N-207.000
Priority: 19

Description of Recommended Project or Activity

The Preserve's objective for this project is to evaluate the desirability of an Outstanding National Resource Waters designation, and, if appropriate, pursue such a designation through the regulatory process. Prior to initiating the process, the Preserve will need to consult with the solicitors office, Everglades and Biscayne National Parks (because they are currently proposed as ONRW designations), and the NPS Water Resource Division. Implementation of project statement BICY-N-074 (Develop a Water Quality Baseline for the Preserve) will be necessary to provide a quantitative baseline of water quality conditions as required by statute for the implementation for the non-degradation standards. The ONRW designation process will involve the following four actions:

1. Preparation of a request for redesignation, and submission to the Florida Department of Environmental Protection. This is a relatively straight forward procedure, as presented in Section 120.54 of the Florida Statutes.

2. Participate in a series of state-conducted workshops to seek input on the proposal. A substantial amount of background material will have to be assembled to demonstrate that the ONRW designation is appropriate and clearly needed in order to protect the resources of the Preserve.

3. Provide support to the state in their analysis of benefits and costs of an ONRW designation.

4. Coordinate with, and where necessary provide testimony to, the state legislature or individual legislators.

It is anticipated that this project can be accomplished over a one-year period, at least up to the point of legislative action. However, two years of funding are requested because the schedule of meetings and analysis will be set by the state and will probably not coincide with Federal fiscal years. Specifically, additional funds are requested to cover the costs of travel to meetings, preparation of exhibits, data analysis, and to back-fill behind the Preserve hydrologist as his/her time is devoted to this project.

BUDGET AND FTEs:

----------FUNDED----------

	Source	Activity	Budget ($1000's)	FTEs
1995:				
1996:				
1997:	PKBASE-NR	PRO		0.2
1998:	PKBASE-NR	PRO		0.1
		Total:	0.0	0.3

----------UNFUNDED----------

	Source	Activity	Budget ($1000's)	FTEs
1995:				
1996:				
1997:	PKBASE-NR	PRO	10.0	
	NPS	PRO	5.0	0.1
1998:	PKBASE-NR	PRO	10.0	
	PKBASE-RES	PRO	5.0	
		Total:	30.0	0.1

Compliance codes: OTHER

Explanation: 516 DM2 App. 2, 2.10

End of data

BICY-N-208.000
Priority: 20

Title: MONITOR IMPACTS OF OIL & GAS OPERATIONS ON WATER RESOURCES

Funding Status: Funded: 0.0 Unfunded: 6.0

Servicewide Issues : N10 (MINRL/GEOTHERM)
N20 (BASELINE DATA)

Cultural Resource Type : C70
RMAP Program codes : Q01

Problem Statement

Active oil and gas operations in the Preserve pose a threat to the water resources in the Preserve. When the Preserve was created in 1974, Congress specifically reserved oil and gas rights for the original owners. Although rights to 90 percent of the land surface in the Preserve have been acquired from the original owners, less than one percent of the oil and gas rights are Federally-owned. There are 22 miles of common carrier pipeline which continues east from the Preserve and transports crude oil to Port Everglades, Florida. Although Bear Island and Raccoon Point fields, located along the Sunniland Trend, are currently the only actively-producing fields in the Preserve, the likelihood of future development exists.

Current oil and gas operations are in compliance with approved plans and subject to frequent field monitoring checks. Operations to date have fortunately had limited impact on the water resources. However, the potential for impacts to the local environment exist as illustrated by the following occurrences:

1. In 1983, a tanker truck overturned along Eleven Mile Road within the Preserve, spilling approximately 60 barrels of oil into the surrounding environment (Schneider and Flora, 1986).

2. In 1984, brines from a temporary surface storage impoundment at the Raccoon Point oil field degraded water quality and resulted in damage to vegetation located downgradient from the impoundment. Peak chloride concentrations of 1380 mg/l were detected at a shallow downgradient monitoring well. Background chloride concentrations for the area ranged from 13 mg/l to 42 mg/l (Roy et al., 1987).

3. High concentrations of chloride (+5000 mg/l) have been detected around several exploratory oil well sites (McPherson, 1974).

The 729,000 acre Preserve is a unique water-dependent ecosystem resulting from a combination of its climate and physiographic setting: the climate provides the hydrological input; the physiographic setting controls the distribution of the input. As much as 90 percent of the Preserve is inundated to depths ranging from a few inches to more than three feet during the wet season (May-October). During the dry season (November-April), water levels recede, reducing the areas inundated in the Preserve to approximately 10 percent. The ecology of the Preserve is finely tuned to the seasonal flow of non-polluted water and any interference can alter this sensitive habitat. As a result, strict monitoring of the oil and gas operations in the Preserve is necessary to ensure the protection of the Preserve's water resources.

BICY-N-208.000
Priority: 20

Description of Recommended Project or Activity

This program will require the Preserve to work closely with the oil & gas operators during all exploration, drilling and production operations. The objective of the program is provide an early warning monitoring network of the local water resources during oil & gas operations.

This project will accomplish this objective as follows:

1. Review all proposed water monitoring plans prior to implementation. Determine if the proposed monitoring program meets the requirements defined in the Preserve's Minerals Management Plan. It will be necessary to develop each monitoring program to the potential site specific impacts. Among the elements of each monitoring plan will be the action levels which will trigger more intensive monitoring or remedial actions.

2. Once an approved monitoring plan is implemented, the Preserve should provide random audits of the monitoring procedures. All water quality data submitted to the Preserve should be reviewed on a frequency that ensures adequate protection of the Preserve's water resources.

3. Develop a water quality database for each of the established monitoring stations.

The project activity will be based upon Oil & Gas activity within the Preserve. It will be important for the Hydrologist to work closely with the Minerals Management Specialists during the project. This project will compliment the efforts defined in project statement BICY-N-104.

Literature Cited

McPherson, B.F., 1974. The Big Cypress Swamp, pages 8-17 in P.J. Gleasen, ed., Environments of South Florida: Present and Past. Miami Geological Soc. Memoir 2, Miami, FL.

Roy, C., M.D. Flora, and B. Freet, 1987 (unpubl). Groundwater Contamination Studies During Oil Well Drilling at Big Cypress National Preserve.

Schneider, W.J., and M.D. Flora, 1986 (unpubl). Hydrological Assessment of the Big Cypress National Preserve: A Water Resources Analysis for the General Management Plan (GMP) and Minerals Management Plan (MMP), N.P.S., Water Resources Division, Colorado State University, Ft. Collins, CO. 5-8, 35-42 pp.

----------FUNDED----------

	Source	Activity	Budget ($1000's)	FTEs
1995:	PKBASE-NR	MON		0.1
1996:	PKBASE-NR	MON		0.1
1997:	PKBASE-NR	MON		0.1
1998:	PKBASE-NR	MON		0.1
		Total:	0.0	0.4

----------UNFUNDED----------

	Source	Activity	Budget ($1000's)	FTEs
1995:				
1996:	PKBASE-NR	MON	2.0	
1997:	PKBASE-NR	MON	2.0	
1998:	PKBASE-NR	MON	2.0	
		Total:	6.0	0.0

Alternative Actions/Solutions and Impacts

No action. This alternative will minimize the Preserve's ability to audit the water quality monitoring program(s) for the active oil and gas operations in the Preserve.

Compliance codes: EXCL

Explanation : 516 DM2 App. 1.6
516 DM6 App. 7.4 E(3)

End of data

BICY-N-209.000
Priority: 21

Title: MONITOR SALINITY GRADIENTS IN CANALS AND ESTUARIES

Funding Status: Funded: 0.00 Unfunded: 48.0

Servicewide Issues : N09 (COASTAL DYNAM)
N11 (WATER QUAL-EXT)
N12 (WATER FLOW)
N20 (BASELINE DATA)

Cultural Resource Type : C57, C70
RMAP Program codes : Q01

Problem Statement

There is currently no available data to assess the relationship of fresh water flows from the Preserve to the estuarine environment of Everglades National Park. A significant length of Florida's Gulf Coast has been affected by altered patterns of fresh water inflows from borrow canals which travel north-south in the Preserve. As part of its marine research and monitoring activities, Everglades National Park has established 13 sites to document stage, water movement and salinity in the estuarine environment. It is important for the Preserve to compliment these efforts to better evaluate changes in salinity gradients within the Preserve's borrow canals which flow into the estuarine environment.

The man-made borrow canals in the Preserve provide a direct hydraulic connection between the fresh-water uplands of the Preserve and the saline estuaries within Everglades National Park. The orientation of a canal relative to flow direction determines the degree of influence it will have on the water resources. Canals which parallel flow in the Preserve produce an accelerated drainage of the immediate area (Duever et al., 1986). This unnatural drainage introduces greater fresh water deliveries to the estuarine environment. During the dry season when fresh water flows decrease, saline waters from the estuaries move though the canals and into freshwater environments impacting fresh water plant and animal communities. The visual effect has been a noticeable increase in mangroves in the bays and estuaries along the coastline. Roads and canals that are perpendicular to the direction of flow can create a barrier to natural mixing patterns.

The Turner River is a small meandering stream originating in the mixed cypress of the Preserve and eventually emptying into the estuaries of Everglades National Park. The natural flow regime of this fluvial system was impacted by roads and canals within its watershed. These roads and borrow canals intercepted recharge waters for the Turner River watershed. As a result, specific conductivity values of the Turner River increased (exceeding 2000 µmhos/cm), indicating salt water encroachment. In response to this problem, the Preserve installed a series of earthen plugs in the borrow canals, to impede over-draining of the watershed, and culverts beneath the roads to allow surface water to continue a natural flow through the watershed (Rosendahl and Sikkema, 1981). This mitigation technique, implemented in 1989, resulted in increased discharges and reduced specific conductivity of the river.

The 729,000 acre Preserve is a unique water-dependent ecosystem resulting from a combination of its climate and physiographic setting: the climate provides the hydrological input; the physiographic setting controls the distribution of the input. As much as 90 percent of the Preserve is inundated to depths ranging from a few inches to more than three feet during the wet season (May-October). During the dry season (November-April), water levels recede, reducing the areas inundated in the Preserve to approximately 10 percent. The ecology of the Preserve is finely tuned to the seasonal flow of water and any interference can alter this sensitive habitat. As a result, excessive drainage of fresh water through canals will increase salinity concentrations and thus disrupt the natural balance of the fresh water environments. Salinity gradients need to be monitored

in the canals and estuarine environments to identify problems associated with the unnatural drainage of fresh water in the Preserve and Everglades National Park.

Description of Recommended Project or Activity

This project will require identifying areas in the Preserve which are subjected to excessive fresh water drainage and monitoring water quality and flows within these areas and relatively unimpacted control areas. The primary objectives of this project are to define the extent of unnatural salinity gradients in the canals and estuarine environments and to provide remedial alternatives to resolve these impacts.

The project will accomplish these objectives as follows:

1. Identify the areas along canal systems where changes in vegetative communities, water conductivity, chloride and/or sodium have been documented.

2. Monitor these areas for specific water quality parameters (i.e., conductivity, chloride, sodium) and surface water discharge to evaluate seasonal concentration ranges of the indicator parameter(s) and flow. Specific monitoring sites should include; Barron River Canal, Turner River Canal (south of U.S. Hwy 41), Turner River (south of U.S. Highway 41) and the borrow canal system at the Preserve's Headquarters in Ochopee.

3. Evaluate data and compare with background water quality data. Identify unnatural anomalies or trends in salinity gradients. Incorporate plant and/or animal indicator species, if present, into the supporting evidence of variation in salinity gradients.

4. Develop mitigation alternatives to correct any anomalous salinity gradients identified during the project.

Major elements to accomplish this project will include the hiring of a base-funded GS-9 Hydrologist for two years during the initial project field work. This temporary FTE would be complimented with the Preserve's existing staff (i.e., Hydrologist, Hydrological Technician, GIS Specialist) to provide the necessary support to accomplish the objectives of this project. Management of the Preserve is committed to the necessary efforts for this project. The GS-9 FTE could also support the personnel needs for project statements BICY-N-106 and BICY-N-202. Additional support from external sources (i.e., South Florida Water Management District, U.S. Geological Survey, etc.) will be pursued to produce the most cost effective approach to the project.

Literature Cited

Duever, M.J., J.E. Carlson, J.F. Meeder, L.C. Duever, L.H. Gunderson, L.A. Riopelle, T.R. Alexander, R.F. Meyers, and D.P. Spangler, 1986. The Big Cypress National Preserve. Research Report No. 8 of the National Audubon Society. 444 pp.

Rosendahl, P.C., and D.A. Sikkema, 1981. Water Management Plan: Turner River Restoration, Report M-621. National Park Service, South Florida Research Center, Everglades National Park, Homestead, FL. 44 pp.

BUDGET AND FTEs:

----------FUNDED----------

	Source	Activity	Budget ($1000's)	FTEs
1995:	PKBASE-NR	MON		0.1
1996:				
1997:				
1998:				
		Total:	0.0	0.1

----------UNFUNDED----------

	Source	Activity	Budget ($1000's)	FTEs
1995:				
1996:	PKBASE-NR	RES	5.0	0.1
	NPS	RES	5.0	
	ST-LOCAL	RES	5.0	
1997:	PKBASE-NR	MON	8.0	0.1
	ST-LOCAL	MON	15.0	
1998:	PKBASE-NR	RES	10.0	0.1
		Total:	48.0	0.3

Alternative Actions/Solutions and Impacts

No action. This alternative would impede cooperative efforts between the Preserve and Everglades National Park while also limiting hydrological data which would assist with management decisions of the National Park Service.

Compliance codes: EXCL

Explanation : 516 DM2 App. 1.6
516 DM6 App. 7.4 E(3)

End of data

BICY-N-210.000
Priority: 22

Title: IDENTIFY WETLAND RECLAMATION PROJECTS

Funding Status: Funded: 0.0 Unfunded: 20.0

Servicewide Issues : N05 (NON-NAT PLANTS)
N06 (LAND USE PRAC)
N12 (WATER FLOW)
Cultural Resource Type : N/A
RMAP Program codes : Q01

Problem Statement

The Preserve should develop a prioritized list of wetland restoration projects that could be undertaken by external entities that are required to restore wetlands as an offset to wetlands they propose to impact. In implementing Section 404 of the Clean Water Act, the U.S. Army Corps of Engineers can require the restoration of wetlands as part of their project approval, and the Preserve has numerous areas of impacted wetlands.

There are numerous sites in the Preserve which have been identified as impacting the local wetlands. These impacts include the modification of historical surface water flow patterns, changes in water quality (i.e., salt water intrusion), the establishment of exotic vegetation, and dredging and filling.

The sites impacting wetlands include abandoned roadways and fill pads from previous minerals operations or private inholding sites purchased by the Preserve. Roadways and fill pads perpendicular to surface water flow often act as levees, causing longer and deeper inundation on the upstream side and reduced inundation downstream (Duever et al., 1986). Canals (i.e., Barron River Canal, L-28 and L-28 Interceptor Canals, etc.) and borrow pits (i.e., Jetport borrow pits, etc.) located within the Preserve's watershed are some other examples of man-made structures which impact wetlands. The hydrological influence from canals is based upon the canal's orientation relative to the surface water flow direction. Canals in the Preserve which parallel natural flow will accelerate drainage of the wetlands. Exotic plant communities (i.e., Melaleuca (Melaleuca quinquenervia), Brazilian pepper (Schinus terebinthifolius)) compete with and restrict the sites available in the Preserve for native species, thus impacting the natural ecosystem, including the water resources. Temperature and water are important in regulating the activities of ecosystem decomposers (Odum, 1971). In the absence of fire, it is not unusual to find a rich layer of undecomposed leaf litter in a Melaleuca forest. This can create an elevated tree island in wetlands where one had not existed and potentially impact surface water flow in the immediate area. Invasion by extensive Melaleuca populations may also hinder the ability of the surficial aquifer to recharge with more water being removed form the system through increased evapotranspiration (Hofstetter, 1991).

An example of a successful wetlands reclamation project in the Preserve is the 1989 Turner River restoration project. The Turner River is a small meandering stream originating in the mixed cypress of the Preserve and eventually emptying into the estuaries of Everglades National Park. The natural flow regime of this fluvial system was impacted by roads and canals within its watershed. These roads and borrow canals intercepted recharge waters for the Turner River watershed. As a result, specific conductivity values of the Turner River increased (exceeding 2000 µmhos/cm), indicating salt water encroachment. In response to this problem, the Preserve installed a series of earthen plugs in the borrow canals, to impede over-draining of the watershed, and culverts beneath the roads to allow surface water to continue a natural flow through the watershed (Rosendahl and Sikkema, 1981). This mitigation technique resulted in an increased discharge and reduced specific conductivity of the river. Additional mitigation (i.e., culverting, removal of impacting roadways, etc.) will be necessary to further enhance the natural function of the Turner River watershed.

The 729,000 acre Preserve is a unique water-dependent ecosystem. As much as 90 percent of the Preserve is inundated to depths ranging from a few inches to more than three feet during the wet season (May-October). During the dry season (November-April), water levels recede, reducing the areas inundated to approximately 10 percent. The wetlands ecology of the Preserve is finely tuned to the seasonal flow of unpolluted water and any interference can alter this sensitive habitat. As a result, it will be important to support wetlands reclamation efforts within the Preserve's watershed in order to better protect the water resources of Big Cypress National Preserve and Everglades National Park.

Description of Recommended Project or Activity

The Preserve's objective for this project is to better define the wetland restoration needs and the necessary scope of work needed to accomplish each of the respective reclamation projects.

The project will accomplish this objective as follows:

1. Prepare a prioritized list of wetland reclamation projects (including impacted acreage and anticipated scope of work).

2. Contact the Corps of Engineers 404 Offices and the Florida Department of Environmental Protection and advise them that the Preserve has identified disturbed wetlands that are available for restoration.

3. Annually amend the list of wetland reclamation projects, as necessary.

4. Conduct appropriate monitoring of each wetland reclamation project to better ensure the effectiveness of the restoration project.

5. Prepare a summary report for each reclamation project.

It will be important for the Preserve to work closely with the various external groups implementing the restoration projects in order to confirm that the project work is being conducted in a manner satisfactory to the management of the National Park Service. The Preserve will allow for such reclamation projects within its boundaries only after all appropriate regulatory agencies approve of the defined scope of work for each project. The Preserve should deny external support for wetland reclamations which directly compete with the purchasing of wetland areas that would be dedicated to the state. In this case, a denial for wetland mitigation in the Preserve would increase the acreage of protected wetlands in Florida since wetlands within the National Park Service boundaries are already federally protected. This project will compliment the efforts defined in project statements BICY-N-104, BICY-N-106, BICY-N-204, BICY-N-205, BICY-N-206, BICY-N-208, BICY-N-209, BICY-N-211, BICY-212, and BICY-N-213.

Literature Cited

Duever, M.J., J.E. Carlson, J.F. Meeder, L.C. Duever, L.H. Gunderson, L.A. Riopelle, T.R. Alexander, R.F. Meyers, and D.P. Spangler, 1986. The Big Cypress National Preserve. Research Report No. 8 of the National Audubon Society. 444 pp.

Hofstetter, R.H., 1991. Transpiration Water Loss from Sawgrass and Cattail. Department of Biology, University of Miami, Coral Gables, Florida. Page 18 in F.B. Laroche, ed., Melaleuca Management Plan for Florida, 1994.

Odum, E.P., 1971. Fundamentals of Ecology. Third Edition. W. B. Saunders Co., Philadelphia. Page 19 in F.B. Laroche, ed., Melaleuca Management Plan for Florida, 1994.

Rosendahl, P.C., and D.A. Sikkema, 1981. Water Management Plan: Turner River Restoration, Report M-621. National Park Service, South Florida Research Center, Everglades National Park, Homestead, FL. 44 pp.

BUDGET AND FTEs:

----------FUNDED----------

	Source	Activity	Budget ($1000's)	FTEs
1995:				
1996:	PKBASE-NR	MIT		0.1
1997:	PKBASE-NR	MIT		0.1
1998:	PKBASE-NR	MIT		0.1
		Total:	0.0	0.3

----------UNFUNDED----------

	Source	Activity	Budget ($1000's)	FTEs
1995:				
1996:	PKBASE-NR	MIT	5.0	
	NPS	MIT	5.0	
1997:	PKBASE-NR	MIT	5.0	
1998:	PKBASE-NR	MIT	5.0	
		Total:	20.0	0.0

Alternative Actions/Solutions and Impacts

No action. This alternative would limit the Preserve's ability to work cooperatively with external groups on wetland reclamation projects within the Preserve's boundaries.

Compliance codes: EXCL

Explanation: 516 DM2 App. 1.6
516 DM2 App. 7.4 E(3)

End of data

BICY-N-211.000
Priority: 23

Title: IDENTIFY AND MONITOR IMPACTS FROM OFF-ROAD VEHICLE USE

Funding Status: Funded: 0.0 Unfunded: 40.0

Servicewide Issues : N18 (VIS USE-BCTRY)
N12 (WATER FLOW)
N20 (BASELINE DATA)

Cultural Resource Type : C70
RMAP Program codes : C03, Q01

Problem Statement

Big Cypress National Preserve does not have a comprehensive inventory of the "areas of influence" from off-road vehicle (ORV) use or a good understanding of the associated impacts to the water resources. Some independent site-specific studies conducted in the past by the Preserve identified some measurable impacts to the water resources (i.e., elevated surface water turbidity, changes in surface water flow direction and velocity) from ORV use.

P. L. 93-440, which established Big Cypress National Preserve, supports the preservation of recreational activities (i.e., ORV use) of the Big Cypress watershed. Executive Orders 11644 and 11989, "Use of Off-Road Vehicles on Public Lands", and "Off-Road Vehicles on Public Lands", respectively, mandate management actions for the use of ORV's on public interest lands such as the Preserve. Executive Order 11990, "Protection of Wetlands", further mandates the protection of wetlands, such as those found in the Preserve. In consonance with these regulations, the Preserve has attempted to manage ORV use in order to minimize degradation of the natural resources. To date, management practices have met with limited success.

The various permitted ORV's in the Preserve consist of airboats, all-terrain vehicles (ATV's), swamp buggies and four-wheel drive street legal vehicles. Current trends show that ORV use in the Preserve continues to increase. Studies have shown that some ORV use (i.e., swamp buggy) results in soil displacement with no natural mechanisms capable of restoring the original topography and the ruts remain indefinitely (Duever et al., 1986). Preliminary 1995 studies of airboat impacts on local hydrology suggest that airboat trails alter the local surface water flow direction and velocity. In 1995, the Preserve initiated efforts to prepare an ORV Management Plan to define best management practices for operation of ORV's within the various management units of the Preserve.

The 729,000 acre Preserve is a unique water-dependent ecosystem resulting from a combination of its climate and physiographic setting: the climate provides the hydrological input; the physiographic setting controls the distribution of the input. As much as 90 percent of the Preserve is inundated to depths ranging from a few inches to more than three feet during the wet season (May-October). During the dry season (November-April), water levels recede, reducing the areas inundated in the Preserve to approximately 10 percent. The ecology of the Preserve is finely tuned to the seasonal flow of water and any interference can alter this sensitive habitat. As a result, it is important understand the extent ORV impacts on the water resources and incorporate appropriate ORV management to minimize these impacts.

BICY-N-211.000
Priority: 23

Description of Recommended Project or Activity

This project will include the inventory of ORV impacted areas in the Preserve, along with monitoring the associated impacts. The objective of the program is to monitor ORV impacts on the water resources and identify impacts which are significantly degrading the water resources.

The project will accomplish this objective as follows:

1. Identify locations where high ORV use in the Preserve has been documented.

2. Define and input the "area of influence" from ORV use into the Preserve's Geographic Information System. This could be accomplished by visual definition (i.e., ORV trails, vegetation impacts, etc.) using the Preserve's high altitude photographs.

3. Identify and prioritize the ORV's "areas of influence" which potentially impact the water resources in the Preserve.

4. Conduct site-specific studies to assess the water quality and quantity impacts on the local water resources. These site-specific studies would primarily focus on the following:

   a. topographical alterations - survey topographic elevations of the "area of influence".
   b. surface water flow and/or velocity alterations - in most cases dye tracing would be employed to effectively determine flow direction and velocity due to the typically low water velocity of sheet flow.
   c. water quality alterations - primarily turbidity.
   d. vegetation alterations - this would involve assistance from a qualified professional (i.e., botanist).

   The establishment of photo-documentation locations within the "area of influence" would also be employed to compliment the information collected from items a - d.

5. Provide recommendations for water resource protection, as necessary, based on results of each site-specific study.

Due to the controversial nature of ORV management in the Preserve, it is recommended that the Preserve contract an independent researcher to conduct the necessary studies, if funding can be secured. In order to make this project more cost-effective, the Preserve would conduct initial ORV-use studies to identify a priority for site-specific research. A major element to accomplish this project include hiring of a base-funded GS-9 hydrologist for 2 years to accomplish the field work and data management needs for this project. This project will require approximately 0.3 FTE/year effort of this position. This project will support the efforts defined in project statement BICY-N-104.

Literature Cited

Duever, M.J., J.E. Carlson, J.F. Meeder, L.C. Duever, L.H. Gunderson, L.A. Riopelle, T.R. Alexander, R.L. Myers, and D.P. Spangler, 1986. The Big Cypress National Preserve. Research Report No. 8 of the National Audubon Society. 444 pp.

BUDGET AND FTEs:

----------FUNDED----------

	Source	Activity	Budget ($1000's)	FTEs
1995:				
1996:				
1997:				
1998:				
		Total:	0.0	0.0

----------UNFUNDED----------

	Source	Activity	Budget ($1000's)	FTEs
1995:				
1996:	PKBASE-NR	RES	10.0	0.3
	NPS	RES	10.0	
1997:	PKBASE-NR	MON	10.0	0.3
1998:	PKBASE-NR	MON	10.0	0.3
		Total:	40.0	0.9

Compliance codes: EXCL

Explanation: 516 DM2 App. 1.6
516 DM6 App. 7.3 E(3)

End of data

BICY-I-212.000
Priority: 24

Title: IDENTIFY AND MONITOR TRADITIONAL INDIAN LAND USES

Funding Status: Funded: 0.0 Unfunded: 40.0

Servicewide Issues : N12 (WATER FLOW)
N20 (BASELINE DATA)

Cultural Resource Type : C70
RMAP Program codes : C03, Q01

Problem Statement

The Preserve does not have a complete inventory of specific American Indian land uses and respective locations. An inventory of traditional use sites and an assessment of impacts at those sites is proposed, along with follow-up work to correct any problems and mitigate impacts that are identified.

Traditional use and occupancy of the Preserve by the Miccosukee and Seminole Tribes of Florida is authorized by P.L. 93-440. Land occupancy within the Preserve by the Miccosukee Tribe in 1996 consists of 11 villages, each consisting of 10 structures or less on less than two acres of land located along the Tamiami Trail (Goss, 1994). Disposal methods for sewage and household wastes at each village varies. Due to the proximity of the villages to the Tamiami Canal, runoff from these areas quickly enters the waters of the canal system. The Miccosukee Tribe of Indians submitted a proposal in 1995 to construct 65 homes, 64 along Loop Road. Issues of consequence include, but are not limited to, water quantity, water quality, adequate sewage treatment facilities, and potable water systems.

The resident American Indians predominate use of the natural resources in the Preserve is the gathering of live cypress trees for poles used in chickee construction. Although the harvest is limited at this time, an increase in commercial chickee construction could result in an increase in demand for the live cypress trees. Areas subjected to concentrated harvesting in the Preserve may result in local disturbances to the land surface. Such land disturbances could alter the water regime in the immediate area.

The 729,000 acre Preserve is a unique water-dependent ecosystem resulting from a combination of its climate and physiographic setting: the climate provides the hydrological input; the physiographic setting controls the distribution of the input. As much as 90 percent of the Preserve is inundated to depths ranging from a few inches to more than three feet during the wet season (May-October). During the dry season (November-April), water levels recede, reducing the areas inundated in the Preserve to approximately 10 percent. The ecology of the Preserve is finely tuned to the seasonal flow of clean water and any interference can alter this sensitive habitat. As a result, studies are necessary to determine if degradation to water quality exists within the immediate areas of Indian occupancy and land use.

The Preserve has developed a strong working relationship with the Seminole Tribe of Florida's Big Cypress Reservation on natural resource issues. The Tribe and Preserve are working toward establishing a water monitoring network that would compliment the resource management needs of the Big Cypress Reservation and Big Cypress National Preserve. Communication between the Preserve and Miccosukee Tribe of Indians of Florida have also produced positive input regarding the high water deliveries into Water Conservation Area 3A, which eventually is discharge into Everglades National Park and Big Cypress National Preserve.

BICY-I-212.000
Priority: 24

Description of Recommended Project or Activity

The objective of the project is to identify any significant Indian land use impacts to the Preserve's water resources and to work with the tribes and state of Florida to correct or mitigate those impacts. This project will include the identification and locations of Indian occupancy and land uses in the Preserve and hydrological monitoring of each respective location, as necessary.

The project will accomplish this objective as follows:

1. Identify the locations of all Indian occupancy and land uses within the Preserve's boundary, through the use of aerial photographs, contacts with tribal members, and site visits.

2. Input the Indian occupancy and land use boundaries into the Preserve's Geographic Information System.

3. Prioritize study areas based on site specific conditions (i.e., area of influence, resources sensitivity, etc.). Areas with the greatest potential to impact the water resources will be studied first.

4. Each study will include a water quality and/or water quantity assessment. Specific water quality parameters will be defined based on the site specific conditions observed within the area.

5. Individual studies will expand, as necessary, to fully assess impacts to the surrounding environment.

6. Summary reports will be prepared which identify any hydrological impacts and include any necessary recommendations.

7. As results become available, the Preserve will work with the tribes and state of Florida to correct and mitigate the problems that are identified.

A three year study is proposed. The first year will consist of reconnaissance, site identification, and the design of the site specific studies (tasks 1, 2, 3, and 4 previously identified). The second and third years will entail data collection, analysis, report production, follow-up studies and work to correct the problems that are identified. It is anticipated that contacts with the tribes and state will continue beyond the completion of this project. A major element to accomplish this project will include the hiring of a base-funded GS-9 scientist for three years to accomplish the field work and data management needs. This project would require approximately 0.2 FTE/year effort of this position. This temporary FTE would be complimented with the Preserve's existing staff (i.e., Hydrologist, GIS Specialist, etc.) to provide the necessary support to accomplish the objective of the project. This temporary FTE could also support the personnel needs for project statement BICY-I-213. This project will support the efforts defined in project statement BICY-N-104.

Literature Cited

Goss, J.A., 1994. Usual and Customary Occupancy by the Miccosukee and Seminole Indians in Big Cypress National Preserve: National Park Service (draft in review).

BUDGET AND FTEs:

----------FUNDED----------

	Source	Activity	Budget ($1000's)	FTEs
1995:				
1996:				
1997:				
1998:				
		Total:	0.0	0.0

----------UNFUNDED----------

	Source	Activity	Budget ($1000's)	FTEs
1995:				
1996:	PKBASE-NR	RES	10.0	0.2
	NPS	RES	10.0	
1997:	PKBASE-NR	RES	10.0	0.2
1998:	PKBASE-NR	RES	10.0	0.1
		Total:	40.0	0.5

Compliance codes: EXCL

Explanation: 516 DM2 App. 1.6
516 DM6 App. 7.4, E(3)

End of data

BICY-I-213.000
Priority: 25

Title: IDENTIFY AND MONITOR NON-FEDERAL LAND USES

Funding Status: Funded: 0.0 Unfunded: 45.0

Servicewide Issues : N12 (WATER FLOW)
N19 (CONSUMPT USE)
N20 (BASELINE DATA)

Cultural Resource Type : C70
RMAP Program codes : C03, Q01

Problem Statement

Impacts from non-Federal land uses on the Preserve's water resources are unknown. P.L. 93-440 and P.L. 100-301 provided for "inholdings" in the Preserve: lands under ownership by other than the Federal government. Under the laws, no properties improved prior to November 23, 1971 could be acquired by the Federal government unless the owner agrees to the acquisition. More than 6 percent of the Preserve's original boundary (approximately 38,709 acres) are inholdings consisting of townships under control of local school boards, the Jetport site under control of the Dade County Port Authority, state and county roads, and privately owned tracts. The 1988 additions to the Preserve increased the inholding acreage because acquisition has not begun for these tracts.

The most significant of these non-Federal lands to the integrity of the Preserve's water resources are the 1,271 acres in privately-owned tracts concentrated along U.S. Highway 41 (Tamiami Trail) and various state and county roads. Due to the proximity of these non-Federal lands to the borrow canals along the Tamiami Trail and various state and county roads, runoff from these areas quickly enters the waters of the borrow canal adjacent to the roads. Waste management practices on non-Federal lands are not closely monitored by county and/or state authorities for compliance due to their remote locations. Non-compliance waste management practices documented by the Preserve include:

1. Seven open pits, lined with dry-brick, used to receive non-treated sewage at a trailer park along Loop Road in the Preserve. There was also no leach field for this sewage system. Two of the seven open pits were located in wetlands. Many site inspections have identified septic systems that do not meet proper compliance design and operation.

2. Junked vehicles were dumped directly into wetlands along Loop Road.

3. A 1989 study was conducted to assess sources of fish contamination that was impacting the wading birds in the Preserve. One of the possible contamination sources identified in this study was from an area where grey water discharged directly into Preserve's wetlands from a backcountry camp located on non-Federal lands.

The management of the Preserve has no direct authority over non-Federal lands, and is dependent upon local authorities for direct control and adherence to codes and regulations. The Preserve works closely with Monroe and Collier County's regulatory agencies and the Department of Community Affairs, with limited success, to bring non-Federal lands into proper compliance.

The 729,000 acre Preserve is a unique water-dependent ecosystem resulting from a combination of its climate and physiographic setting: the climate provides the hydrological input; the physiographic setting controls the distribution of the

input. As much as 90 percent of the Preserve is inundated to a depth ranging from a few inches to more than three feet during the wet season (May-October). During the dry season (November-April), water levels recede, reducing the areas inundated in the Preserve to approximately 10 percent. The ecology of the Preserve is finely tuned to the seasonal flow of clean water and any interference can alter this sensitive habitat. As a result, studies are necessary to determine if degradation to water quality exists within the immediate area of non-Federal lands.

Description of Recommended Project or Activity

The objective of this project is to identify and document water resource impacts that might be associated with non-Federal lands, and to initiate actions to correct or mitigate them. This program will include the identification of non-Federal lands in the Preserve and hydrological monitoring of each respective location, as necessary.

The project will accomplish this objective as follows:

1. Input all non-Federal land boundaries into the Preserve's Geographic Information System utilizing aerial photographs, property tract maps and site visits.

2. Prioritize study areas based on site specific conditions (i.e., resources sensitivity, etc.). Areas with the greatest potential to impact the water resources will be studied first.

3. Each study will include a water quality and/or water quantity assessment. Specific water quality parameters will be defined based on the site specific conditions observed within the area.

4. Individual studies will expand, as necessary, to fully assess impacts to the surrounding environment.

5. Summary reports will be prepared which identify any hydrological impacts and include any necessary recommendations.

6. As results become available, the Preserve will work with landowners and the appropriate regulatory agencies to correct and mitigate problems that are identified.

A three year study is proposed. The first year will consist of preparing a Geographic Information System base map for the location for non-Federal lands in the Preserve, and the design of the site specific studies (tasks 1, 2, 3, and 4 above). The second and third years will entail data collection, analysis, report production, follow-up studies and work to correct the problems that are identified. It is anticipated that contacts with the inholders and state will continue beyond the completion of this project. A major element to accomplish this project will include the hiring of a base-funded GS-9 scientist for three years to accomplish the field work and data management needs. This project will require approximately 0.2 FTE/year effort of this position. This temporary FTE would be complimented with the Preserve's existing staff (i.e., Hydrologist, GIS Specialist, etc.) to provide the necessary support to accomplish the objective of the project. This GS-9 FTE could also support the personnel needs for project statements BICY-I-212 and BICY-N-214. This project will support the efforts defined in project statement BICY-N-104.

BUDGET AND FTEs:

----------FUNDED----------

	Source	Activity	Budget ($1000's)	FTEs
1995:				
1996:				
1997:				
1998:				
		Total:	0.0	0.0

----------UNFUNDED----------

	Source	Activity	Budget ($1000's)	FTEs
1995:				
1996:	PKBASE-NR	RES	10.0	0.2
	NPS	RES	5.0	
	ST-LOCAL	RES	10.0	0.1
1997:	PKBASE-NR	RES	10.0	0.2
1998:	PKBASE-NR	RES	10.0	0.2
		Total:	45.0	0.7

Compliance codes: EXCL

Explanation: 516 DM2 App. 1.6
516 DM6 App. 7.4 E(3)

End of data

BICY-N-214.000
Priority: 26

Title: IDENTIFY AND MONITOR IMPACTS FROM GRAZING ON WATER RESOURCES

Funding Status: Funded: 0.0 Unfunded: 25.0

Servicewide Issues : N19 (CONSUMPT USE)
N20 (BASELINE DATA)
Cultural Resource Type : C70
RMAP Program codes : C03, Q01

Problem Statement

The impact of grazing on the Preserve's water resources is unknown. Five lease holders have grazing rights on approximately 29,000 acres in the northwestern corner of the original Preserve boundary. The extent, location and status of all grazing leases within the Additions are not known at this time. Although water quality studies have shown elevated nutrient and bacteria concentrations to be associated with areas where cattle are concentrated (Dale, et al., 1978) (Weeks, 1991), no water quality studies have been conducted in the Preserve to document the impacts from cattle grazing on its water resources.

The waters in the Preserve are classified as Outstanding Florida Waters (62-302.700(8) and (9) F.A.C.), a state designation under the Clean Water Act, which affords the highest level of protection to the existing water quality. As a result, water quality is not to exceed the existing ambient water quality in the Preserve. With few exceptions, water quality in the Preserve is very high, and represents natural conditions more closely than any other waters in south Florida. Water quality in the Preserve is vulnerable to degradation from internal sources (i.e., cattle grazing) and small amounts of contaminants can result in relatively large degradation.

The Shallow Aquifer underlies the majority of the cattle leases in the Preserve. This aquifer is the major source of potable water in southwest Florida. Inflows to the Shallow Aquifer are derived principally from two sources; direct infiltration of precipitation, and subsurface inflows from adjacent areas (Jakob, 1983). As a result, the potential for bacterial and/or nutrient contamination of the aquifer from cattle exists.

The Preserve is contained within Big Cypress Area of Critical State Concern, established in 1973. The purpose of the designation was "to conserve and protect the natural resources and scenic beauty of the Big Cypress Area of Florida" (Florida Department of Environmental Protection & South Florida Water Management District, 1993). The Florida Legislature found that the Big Cypress Area, as a water storage and recharge area, is an integral part of the water resources in southwest Florida. As a result, it is important for the Preserve to not only enforce its national mandated legislation (P.L. 93-440) which established Big Cypress National Preserve, but also the state legislation designed to protect the water resources of south Florida.

The 729,000 acre Preserve is a unique water-dependent ecosystem resulting from a combination of its climate and physiographic setting: the climate provides the hydrological input; the physiographic setting controls the distribution of the input. As much as 90 percent of the Preserve is inundated to depths ranging from a few inches to more than three feet during the wet season (May-October). During the dry season (November-April), water levels recede, reducing the areas inundated in the Preserve to approximately 10 percent. The ecology of the Preserve is finely tuned to the seasonal flow of clean water and any interference can alter this sensitive habitat. As a result, studies are necessary to determine if degradation to water quality exists within the immediate area of the grazing leases.

BICY-N-214.000
Priority: 26

Description of Recommended Project or Activity

This project will allow the Preserve to conduct water quality studies within the leased grazing areas. The objective of the project is to identify any significant impacts from cattle grazing to the water resources.

This objective can be accomplished as follows:

1. Identify all leased grazing areas within the Preserve's boundary and input these boundaries into the Preserve's Geographic Information System.

2. Prioritize initial study areas based on site specific conditions. Areas with the greatest potential to impact the water resources will be studied first. Prioritization would be based on cattle concentration and local hydrology.

3. Each initial study will include analysis of water samples for bacteria (fecal coliform), turbidity, dissolved oxygen, pH, ammonia, water temperature and nutrients (nitrates & phosphates). The use of fecal coliform bacteria has proven to be a good indicator of pollution by warm-blooded animal feces. The initial studies will consist of two or three sampling events to provide a preliminary assessment of water quality impacts, if any.

4. These short-term studies will expand, as necessary, to fully assess impacts to the surrounding environment.

5. Summary reports will be prepared which identify any water quality impacts and include any necessary recommendations.

A three year study is proposed. The first year will consist of preparing a Geographic Information System base map for the location for cattle leases in the Preserve (including the Additions), and design of the site specific studies (tasks 1, 2, 3, and 4 above). The second and third years will entail data collection, analysis, report production, follow-up studies and work to correct the problems that are identified. A major element to accomplish this project will include the hiring of a base-funded GS-9 scientist for three years to accomplish the field work and data management needs. This project will require approximately 0.2 FTE/year effort the first two years and 0.1 FTE/year effort for the third year. This temporary FTE would be complimented with the Preserve's existing staff (i.e., Hydrologist, GIS Specialist, etc.) to provide the necessary support to accomplish the objective of the project. This GS-9 FTE could also support the personnel needs for project statements BICY-I-212 and BICY-I-213. This project will support the efforts defined in project statement BICY-N-104.

LITERATURE CITED

Dale, E.E., R.L. Meyer, D.G. Parker, E.G. Smith and M.D. Springer, 1978. Buffalo National River Ecosystems Part IV, Arkansas Resources Research Center, Publ. No. 58, University of Arkansas, Fayetteville, Arkansas. 10, 93-110 pp.

Florida Department of Environmental Protection & South Florida Water Management District, 1993. Big Cypress Area of Critical State Concern Report, 29 pp.

Jakob, Paul G., 1983. Hydrogeology of the Shallow Aquifer South of Naples, Collier County. South Florida Water Management District, Technical Publication 83-3, West Palm Beach, Florida. 45 p.

Weeks, D.P., 1991. The Agricultural Impact on the Buffalo National River in a Sedimentary Terrain, Boxley Valley, Arkansas, unpubl. master thesis, University of Arkansas, Fayetteville, Arkansas. 109 pp.

BUDGET AND FTEs:

----------FUNDED----------

	Source	Activity	Budget ($1000's)	FTEs
1995:				
1996:				
1997:				
1998:				
		Total:	0.0	0.0

----------UNFUNDED----------

	Source	Activity	Budget ($1000's)	FTEs
1995:				
1996:	PKBASE-NR	RES	5.0	0.2
1997:	PKBASE-NR	MON	5.0	0.2
	ST-LOCAL	MON	5.0	
1998:	PKBASE-NR	MON	5.0	0.1
	ST-LOCAL	MON	5.0	
		Total:	25.0	0.5

Compliance codes: EXCL

Explanation: 516 DM2 App. 1.6
516 DM6 App. 7.4 E(3)

End of data

BICY-I-215.000
Priority: 27

Title: INVENTORY EXISTING UNDERGROUND STORAGE TANKS AND PROPERLY CLOSE OR UPGRADE

Funding Status: Funded: 0.0 Unfunded: 35.0

Servicewide Issues : N24 (OTHER)

Cultural Resource Type : C70
RMAP Program codes : C03, Q01

Problem Statement

The Preserve does not have a comprehensive inventory of existing underground storage tanks (USTs) within its boundaries. There are USTs located in the Preserve that have not been properly closed or upgraded by the responsible parties. USTs with capacities greater than 110 gallons are regulated in the Florida. USTs installed in between 1976 and 1980 must be upgraded (installation of secondary containment and incorporation of monitoring) by 1995. USTs installed between 1980 and 1984 must be upgraded by 1998 and USTs installed after 1984 must be upgraded by 2009. All new and replacement USTs installed after January 1, 1992 must include the appropriate secondary containment and leak detection equipment (Underground Storage Tank Guide, 1994). State requirements for UST closures are very specific. The site assessment for a UST Closure must include analysis of soil and water samples for evaluation of contamination, if any. Contaminated sites must be remediated according to F.A.C. Chapter 62-770, which assimilates Federal regulations delegated to the state by the U.S. Environmental Protect Agency.

In 1991, the Preserve initiated an effort to eliminate USTs from Federal property. The first phase of this project was to identify where USTs were located. During this inventory, USTs were identified at four locations, of which three were inactive sites the National Park Service had acquired. The fourth site was the Preserve's Visitor Center, which was actively used by the Preserve. UST closures were conducted at the three abandoned UST sites (Paolita Station, Monroe Station and Turner River Bar) in 1992. Two of the sites (Monroe Station and Turner River Bar) were clean closures. The UST closure at Paolita Station, located along U.S. Highway 41, involved proper removal of petroleum contaminated soils. Clean-up of this site was completed in 1995. In 1993, USTs were removed from the Visitor Center and petroleum contamination was also detected in the soils. Currently, this site is being evaluated by a contracted consultant to determine the appropriate mitigation technique(s).

P.L. 93-440 and P.L. 100-301 provided for "inholdings" in the Preserve, which are lands under ownership by other than the Federal government. Approximately 38,709 acres within the original Preserve boundary are non-Federal lands. The possibility of on-site USTs for providing fuel to private residents exists in some of the more remote locations. The Additions Act, which adds 147,280 acres to the Preserve's original boundary, will probably increase the number of USTs located within the Preserve. The Preserve should not accept any lands where known UST(s) exist until written authorization by the appropriate regulatory agency is provided to the Preserve which states that the UST(s) are in compliance and no releases have been reported in the past.

The 729,000 acre Preserve is a unique water-dependent ecosystem resulting from a combination of its climate and physiographic setting: the climate provides the hydrological input; the physiographic setting controls the distribution of the input. As much as 90 percent of the Preserve is inundated to depths ranging from a few inches to more than three feet during the wet season (May-October). During the dry season (November-April), water levels recede, reducing the areas inundated in the Preserve to approximately 10 percent. The ecology of the Preserve is finely tuned to the seasonal flow of clean water and any interference can alter this sensitive habitat. The karst geology in the Preserve is conducive to the rapid spread of

contaminates (i.e., gasoline, diesel fuel) due to solution channels and sinkholes associated with the Tamiami limestone, which can create a conduit flow between surface and ground water. As a result, it is important to properly remove all potential pollution sources (i.e., inactive USTs) from the Preserve in order to eliminate threats to the water resources.

Description of Recommended Project or Activity

This project will include the inventory of USTs in the Preserve, including a review of UST compliance and implementation of required upgrades or closures by the responsible party. The objective of the program is to maintain a UST inventory in the Preserve which meets all the state and Federal regulatory requirements, and to protect the resources of the Preserve from damage due to leaking UST systems.

The objective will accomplish this as follows:

1. Identify the locations of all existing USTs in the Preserve.

2. Input the UST locations into the Preserve's Geographic Information System.

3. Review state and National Park Service registration documents and identify all compliance and non-compliance USTs. The reference for UST Regulations in Florida is:

   Department of Environmental Protection
   Division of Waste Cleanup
   Storage Tank Regulation Section
   2600 Blair Stone Road
   Tallahassee, FL 32399-2400
   (904) 488-3935

4. Register and upgrade all National Park Service USTs, as necessary.

5. Contract consultant for UST closures or upgrades, as necessary, for all National Park Service or abandoned USTs.

6. Seek regulatory enforcement for proper closure or upgrades of all non-Federal USTs located in the Preserve by the respective responsible parties, if necessary.

7. Review documentation (i.e., analytical reports) for required remedial activities conducted at contaminated sites.

The first year of this project will consist of reconnaissance, UST identification, and the compliance review for each identified UST site (tasks 1, 2, and 3 above). The second and third year, possibly longer depending on the extent of non-compliance, will consist of registering, upgrading or removing (UST closure) all Preserve USTs, as necessary , and seeking regulatory enforcement for proper UST compliance on non-Federal lands in the Preserve (tasks 4, 5, and 6 above). A major element to accomplish this project will include the hiring of a base-funded GS-7 scientist for three years to accomplish the field work and data management needs for this and other projects. This project would regime approximately 0.2 FTE/year effort of this position. Additional support from external sources (i.e., Florida Department of Environmental Protection) will be pursued to produce the most effective approach to the project. The unfunded budget identified for this project statement would increase significantly if mitigation for UST closures were necessary. This project will support the efforts defined in project statement BICY-N-104.

Literature Cited

Underground Storage Tank Guide, 1994. (Florida State Program) Thomas Publ. Group Inc. 145-146 p.

BUDGET AND FTEs:

----------FUNDED----------

	Source	Activity	Budget ($1000's)	FTEs
1995:				
1996:	PKBASE-NR	RES		
1997:	PKBASE-NR	RES		
1998:	PKBASE-NR	RES		
		Total:	0.0	0.0

----------UNFUNDED----------

	Source	Activity	Budget ($1000's)	FTEs
1995:				
1996:	PKBASE-NR	RES	10.0	0.2
	NPS	RES	10.0	
1997:	PKBASE-NR	RES	5.0	0.2
	NPS	RES	5.0	
1998:	PKBASE-NR	RES	5.0	0.2
		Total:	35.0	0.6

Alternative Actions/Solutions and Impacts

No action. This alternative would minimize the inventory efforts to remove or upgrade existing USTs within the Preserve's boundary. The Preserve would have to rely on the efforts provided by state and Federal regulatory agencies for proper compliance of UST management in the Preserve.

Compliance codes: EXCL

Explanation: 516 DM2 App. 1.6

End of data

BICY-N-216.000
Priority: 28

Title: MONITOR REMEDIATION OF CREOSOTE CONTAMINATION IN JEROME

Funding Status: Funded: 0.1 Unfunded: 0.4

Servicewide Issues : N24 (OTHER)

Cultural Resource Type : C70
RMAP Program codes : Q01

Problem Statement

A monitoring program is needed to track the remediation of creosote contamination at a site located in Jerome, Florida (Section 30, T51S, R30E). The Jerome site is located north of U.S. Highway 41 on State Route 29, within the western Additions of the Preserve. This site is scheduled for transfer to Federal ownership as part of the transfer of a major portion of the Additions to the Preserve under P.L. 100-301. A consent order (OGC Case No. 90-1175) was issued by the Florida Department of Environmental Regulations (currently Florida Department of Environmental Protection) with the Collier Development Corporation (CDC) in 1990 as a result of coal tar creosote contamination detected in the soils and ground water at the Jerome site. CDC is the present owner of the Jerome site.

Collier Development Corporation entered a lease agreement with C.J. Jones between 1940 and 1956 to operate a sawmill which, between 1950 and 1956, included a creosote wood preserving operations on the property. Analytical results from water samples collected from ground water monitoring wells located within the former sawmill site indicated the presence of the following contaminants in the following maximum concentrations (Florida Department of Environmental Regulation, 1990):

- acenapthene = 78 µg/l (micrograms/liter)
- anthracene = 17 µg/l
- benzene = 13 µg/l
- dibenzofuran = 43 µg/l
- fluoranthene = 45 µg/l
- fluorene = 70 µg/l
- 2-methylnapthalene = 23 µg/l
- phenanthrene = 124 µg/l
- pyrene = 24 µg/l
- boron = 45 µg/l

Based on the analytical results, it is evident that a coal tar creosote wood preservative was released to the ground and/or ground water. The above amounts do not conform to certain minimum criteria for ground water established by the Florida Administrative Code (F.A.C.) Rule 17-3.404. Polynuclear aromatic hydrocarbon contamination was detected in local private potable wells by the Collier County Pollution Control Department in 1989.

A network of 21 shallow ground water monitor wells was installed in April 1990 to evaluate the water quality in ground water at the sawmill site. Polynuclear aromatic hydrocarbon contamination was documented in six of the monitor wells and two soil samples located at or regional south-southwest of the site. An additional eight monitor wells had traces of contamination. Based on the analytical results, it was concluded that contamination has moved approximately 1500 feet off-site in conjunction with the south-southwesterly ground water flow pattern. Hydrologic data collected during the study indicate that the shallow ground water flow for the area is in a south-southwesterly direction.

According to Mr. Jeff Gould of the Florida Department of Environmental Protection, the heavily contaminated soils at the site have been incinerated. A January 1991 Contamination Assessment Plan (CAP) and Quality Assurance Project Plan (QAPP) were prepared by CDC and submitted to DER's Quality Assurance Division for approval. As of March 1992, the QAPP was approved pending the receipt of minor revisions. Upon incorporation of these revisions, it is anticipated that the QAPP will be approved by the Florida Department of Environmental Protection and the remedial efforts at Jerome will continue.

The 729,000 acre Preserve is a unique water-dependent ecosystem. As much as 90 percent of the Preserve is inundated to depths ranging from a few inches to more than three feet during the wet season (May-October). During the dry season (November-April), water levels recede, reducing the areas inundated to approximately 10 percent. The ecology of the Preserve is finely tuned to the seasonal flow of unpolluted water and any interference can alter this sensitive habitat. As a result, it will be important that a proper and complete remediation of the soils and ground water at the Jones Mill site be conducted to protect the water resources of the Preserve and surrounding environments.

Description of Recommended Project or Activity

The Preserve's objective for this project is to confirm that remediation of the soils and ground water at the Jones Mill site meets the clean-up standards of the Florida Department of Environmental Protection prior to the National Park Service accepting the property from the CDC.

The project will accomplish this objective as follows:

1. Review all analytical results and summary reports submitted by CDC regarding the remedial project work at the Jones Mill site.

2. Upon completion of the remediation, obtain the approval letter from the Florida Department of Environmental Protection stating that the ground water and soils at the site and surrounding area(s) meet the Florida Department of Environmental Protection's and U.S. Environmental Protection Agency criteria for a clean site and that no further remedial efforts are necessary.

3. Prepare an internal summary report regarding the history of the site, which includes the chronological sequence of events which led to the approved Florida Department of Environmental Protection clean-up.

This project will support the efforts defined in project statement BICY-N-104.

Literature Cited

Florida Department of Environmental Regulation, 1990. State of Florida Department of Environmental Regulation vs Collier Development Corporation, Consent Order (OGC Case No. 90-1175), Ft. Meyers, FL. 2-4 pp.

Law Environmental, Inc. 1991. Contamination Assessment Plan (CAP), Former Creosote Wood Treatment Unit. Former C.J. Jones Lumber Company Site, Jerome, Florida (Project No. 55-0606). 42 pp.

BUDGET AND FTEs:

----------FUNDED----------

	Source	Activity	Budget ($1000's)	FTEs
1995:	PKBASE-NR	MON	0.1	0.05
1996:	PKBASE-NR	MON		0.05
1997:	PKBASE-NR	MON		0.05
1998:				
		Total:	0.1	0.15

----------UNFUNDED----------

	Source	Activity	Budget ($1000's)	FTEs
1995:				
1996:	PKBASE-NR	MON	0.2	
1997:	PKBASE-NR	MON	0.2	
1998:				
		Total:	0.4	0.0

Compliance codes: EXCL

Explanation : 516 DM2 App. 1.6

End of data

BICY-I-217.000
Priority: 29

Title: INVENTORY COMPLIANCE REQUIREMENTS FOR THE PRESERVE'S WATER SUPPLY AND WASTEWATER SYSTEMS

Funding Status: Funded: 0.0 Unfunded: 2.0

Servicewide Issues : N24 (OTHER)

Cultural Resource Type : N/A
RMAP Program codes : E00

Problem Statement

The water supply and wastewater systems of the Preserve need to be maintained in compliance with state standards, and those that are not in compliance need to be improved to acceptable standards. Most of the workload involved in this project consists of routine monitoring and maintenance. It is important that funding be provided to inventory the compliance requirements of the Preserve's water supply and wastewater systems, and to identify non-compliance systems in the Preserve. Proper compliance of the Preserve's water supply and wastewater systems needs to be incorporated by the National Park Service before the Preserve can effectively enforce compliance requirements described in project statements BICY-I-212.000 and BICY-I-213.000.

There are approximately 30 septic systems used for the Preserve's living quarters (individual homes), camp grounds, and Oasis Visitor Center. Each system has an anaerobic leach field. These septic systems gravity feed to the leach field, excluding five systems which feed into a dosing tank that pumps the effluent to the leach field. Some of these septic systems are not in compliance with the most recent Florida regulations. As repairs are made to the existing septic systems, they are upgraded to meet Florida's Health and Rehabilitative Services most current requirements (Chapter 10D-6, F.A.C.).

At Ochopee, the wastewater treatment plant treats wastewater from the Preserve's headquarters and living quarters located in the Lodge. The wastewater treatment include aeration and has a 15,000 gallon per day treatment capacity.

There are nine Preserve residential water wells and two public drinking water systems maintained by the Preserve's Maintenance Division. The wells are approximately 20 feet below ground surface located in the Shallow Aquifer system. The nine residential wells are tested a minimum of five times per week for chlorine and once per month for total chloroform. The two public water systems include Oasis Visitor Center (Public/Non-Community System) and the Preserve's headquarters and living quarters located in the Lodge (Public/Community System).

The potable water system at Ochopee is tested for total coliform (one raw sample per month and five treated samples per month). One sample is also tested for volatile organic compounds each year. The well for the Ochopee potable water system is located on Birdon Road. Approximately 9000 feet of raw line runs from the well to the Ochopee water treatment system. The water is initially treated with chlorine at the well. The water is then transported through an air stripper before entering a 12,000 gallon above-ground storage tank and is chlorinated again to complete the treatment process. All water samples are collected by the Preserve's Maintenance Division and sent to Florida's Health and Rehabilitative Services laboratory in Miami for analyses.

The 729,000 acre Preserve is a unique water-dependent ecosystem resulting from a combination of its climate and physiographic setting: the climate provides the hydrological input; the physiographic setting controls the distribution of the

input. As much as 90 percent of the Preserve is inundated to depths ranging from a few inches to more than three feet during the wet season (May-October). During the dry season (November-April), water levels recede, reducing the areas inundated in the Preserve to approximately 10 percent. The ecology of the Preserve is finely tuned to the seasonal flow of non-polluted water and any interference can alter this sensitive habitat. The waters in the Preserve are classified as Outstanding Florida Waters (62-302.700(8) and (9) F.A.C.), a state designation under the Clean Water Act, which affords the highest level of protection to the existing water quality. As a result, water quality is not to exceed the existing ambient water quality in the Preserve. With few exceptions, water quality in the Preserve is very high, and represents natural conditions more closely than any other waters in south Florida. Water quality in the Preserve is vulnerable to degradation from internal sources (i.e., failed septic systems), simply because of such high water quality, and small amounts of contaminants can result in relatively large degradation.

Description of Recommended Project or Activity

The major objective of this project is to identify potable water and wastewater treatment systems in the Preserve which are not in compliance with the most current state requirements. This objective will be accomplished by the Preserve's Maintenance Division and Hydrology staff working together to ensure that these systems are operated in a manner that minimizes impact to the Preserve's natural resources while meeting the quality control criteria for proper operations. Alternative methods for wastewater treatment should also be considered as better treatment designs are made available. The Hydrology Program will assist with the identification of compliance requirements and the Maintenance Division will implement the required upgrades to meet these requirements. The source of funding for the upgrades would probably be from the Preserve's Maintenance Division and the associated costs are not identified in the project statement. This project will support the efforts defined in project statement BICY-N-104.

BUDGET AND FTEs:

----------FUNDED----------

	Source	Activity	Budget ($1000's)	FTEs
1995:				
1996:	PKBASE-NR	MIT		0.1
1997:	PKBASE-NR	MIT		0.05
1998:	PKBASE-NR	MIT		0.05
		Total:	0.0	0.2

----------UNFUNDED----------

	Source	Activity	Budget ($1000's)	FTEs
1995:				
1996:	PKBASE-NR	MIT	1.0	
1997:	PKBASE-NR	MIT	0.5	
1998:	PKBASE-NR	MIT	0.5	
		Total:	2.0	0.0

Compliance codes: OTHER

Explanation : 516 DM6 App. 7.4 C(10)
516 DM6 App. 7.4 C(18)

End of data

BICY-N-218.000
Priority: 30

Title: SUPPORT EFFORTS TO INVENTORY INDICATOR BIOTA

Funding Status: Funded: 0.0 Unfunded: 30.0

Servicewide Issues : N11 (WATER QUAL-EXT)
N12 (WATER FLOW)
N20 (BASELINE DATA)

Cultural Resource Type : N/A
RMAP Program codes : Q01, V01

Problem Statement

Big Cypress National Preserve does not typically use indicator biota as a tool for assisting with water quality or quantity assessments. For example, the establishment of the various mangroves communities, which include the red mangrove (Rhizophora mangle), white mangrove (Laguncularia racemosa), black mangrove (Avicennia germinans) and buttonwood (Conocarpus erectus), depends upon the water depth and salinity. Areas where mangroves are being replaced by other vegetative communities would indicate possible changes in water salinity and/or water stage. Another potential indicator biota to the hydrological health of the Preserve is periphyton, sessile organisms (i.e., diatoms) that cover the soil over large areas of the wetlands. These living communities have been found to be very sensitive to changes in water quality, and may also be sensitive in the amount and seasonality of surface water flow. The Preserve currently does not have a formal program to identify indicator biota for assisting with impact assessments of the water resources.

The 729,000 acre Preserve is a unique water-dependent ecosystem resulting from a combination of its climate and physiographic setting: the climate provides the hydrological input; the physiographic setting controls the distribution of the input. As much as 90 percent of the Preserve is inundated to depths ranging from a few inches to more than three feet during the wet season (May-October). During the dry season (November-April), water levels recede, reducing the areas inundated in the Preserve to approximately 10 percent. The ecology of the Preserve is finely tuned to the seasonal flow of non-polluted water and any interference can alter this sensitive habitat. As a result, it is important to incorporate all available tools (i.e., indicator biota) to better identify and evaluate trends and anomalies in water quality and/or quantity.

Description of Recommended Project or Activity

The major objective of this project is to properly identify specific indicator biota, that can be used to indicate water quality and/or quantity conditions or trends. This will assist the Preserve with identifying and defining the major factors that affect water quality and/or quantity. This project will accomplish this objective by supporting internal and/or external efforts to identify and inventory potential indicator biota in south Florida. The following statistical correlations should be developed:

1. Specific water quality parameters vs specific indicator biota.

2. Water stage vs specific indicator biota.

3. Variation in specific indicator biota due to seasonal changes.

Water quality data from the Preserve will be made available to investigators testing such correlations. Computing correlation coefficients between indicator biota and water quality and quantity data may determine if a strong or weak association exists between the respective data sets.

BUDGET AND FTEs:

----------FUNDED----------

	Source	Activity	Budget ($1000's)	FTEs
1995:				
1996:	PKBASE-NR	RES		0.1
1997:	PKBASE-NR	MON		0.1
1998:	PKBASE-NR	RES		0.1
		Total:	0.0	0.0

----------UNFUNDED----------

	Source	Activity	Budget ($1000's)	FTEs
1995:				
1996:	PKBASE-NR	RES	0.5	
	NPS	RES	0.5	
1997:	PKBASE-NR	MON	10.0	
1998:	PKBASE-NR	RES	10.0	
		Total:	30.0	0.0

Compliance codes: EXCL

Explanation : 516 DM2 App. 1.6
516 DM6 App. 7.4 E(3)

End of data

APPENDIX B
CONSULTATION, COORDINATION, AND ACKNOWLEDGMENTS

Water Resources Issue Scoping Workshop, 1993

The following Individuals provided valuable input in to the planning process through their participation in a Water Resources Issue Scoping Workshop held at the Preserve on April 14 and 15, 1993.

PARTICIPANT	REPRESENTING
Michael Bennett	South Florida Water Management District
Ron Clark	Big Cypress National Preserve
Terry Clark	South Florida Water Management District
Robert Coughey	Florida Geological Survey
Fred Dayhoff	Unaffiliated
Michael Duever	Audubon Society
Liz Dupree	Big Cypress National Preserve
Robert Fennema	Everglades National Park
Mark Flora	National Park Service, Water Resources Division
Aaron Higer	U.S. Geological Survey
Ron Jones	Florida International University
Pat Kenney	Big Cypress National Preserve
Henry La Rose	U.S. Geological Survey
Nancy Little	South Florida Water Management District
William Loftus	Everglades National Park
Frank Mazotti	Broward County Extension Office
Tom Miller	Big Cypress National Preserve
Ananta Nath	South Florida Water Management District
George San Miguel	Big Cypress National Preserve
William Schneider	Unaffiliated
David Sharrow	National Park Service, Water Resources Division
Dewitt Smith	Everglades National Park
Thomas Smith	Rookery Bay NERR
Jim Snyder	Big Cypress National Preserve
Buck Thackeray	Big Cypress National Preserve
Joel Trexler	Florida International University
Brendhan Zubricki	National Park Service, Southeast Regional Office

Additional Consultation

Additional Consultation was conducted with the following individuals during the course of the planning process.

South Florida Water Management District

Michael Bennett
Maxine Cheesman
Nancy Little
Michael Slayton
Cecelia Weaver

Corps of Engineers

Ronald Hilton
Louis Horning
Glenn Landers
James Vearill

U.S. Geological Survey

Aaron Higer
Ben McPherson
Nancy Simon

Everglades National Park

Elaine Hall
Robert Johnson
David Sikkema

Miccosukee Tribe

Truman Duncan, Jr.

Seminole Tribe

Craig Tepper

Nature Conservancy

Michael Duever

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N. Davies Mtundo, South Florida Water Management District
Carolyn Price, U.S. Geological Survey
Susan Ritter, Everglades National Park
Rob Starzman, South Florida Water Management District
John Boldt, Collier County

APPENDIX C
LIST OF PREPARERS AND ACKNOWLEDGMENTS

Written by

William J. Schneider, Water Resources Consultant
Don P. Weeks, Hydrologist, Big Cypress National Preserve
David L. Sharrow, Hydrologist, NPS Water Resources Division

Contributors

Dennis J. Bartalino, Maintenance Mechanic Supervisor, Big Cypress National Preserve
Christine J. Bates, Hydrological Technician, Big Cypress National Preserve
Ronald E. Clark, Environmental Specialist, Big Cypress National Preserve
Alice E. Johns, Hydrologist, NPS Water Resources Division
Kevin G. Kacer, Management Assistant, Big Cypress National Preserve
Patrick M. Kenney, Resource Management Specialist, Big Cypress National Preserve
Robert W. Thackeray, Ecosystem Manager, Big Cypress National Preserve

Acknowledgments (Photographs)

Ken Meyer, p. 46
Mortenson, 1975, p. 26
Kevin A. Peer, pp. 4, 24, 34, 45
Antonio J. Pernas, p. 37
Jeff Ripple, cover, p. v
William Snyder, p. 36
Don P. Weeks, p. 14, 38

APPENDIX D

DRAFT WATER RESOURCES MANAGEMENT PLAN COPIES DISTRIBUTED FOR REVIEW

Mr. Stuart Applebaum
U.S. Army Corps of Engineers
C&SF Restudy Section
400 West Bay Street
P.O. Box 4970
Jacksonville, Florida 32232

Mr. Bart Bibler, P.E.
1913 Sherwood Drive
Tallahassee, Florida 32303

James Billy (Chairman)
Seminole Tribe of Florida
6073 Stirling Road
Hollywood, Florida 33024

Mr. Ed Carlson, Director
Corkscrew Swamp Audubon Sanctuary
375 Sanctuary Rd. W.
Naples, Florida 33964

Ms. Maxine Cheesman
South Florida Water Management District
Water Quality Monitoring Division
P.O. Box 24680
West Palm Beach, Florida 33416

Billy Cypress (Chairman)
Miccosukee Tribe of Indians of Florida
P.O. Box 440021
Tamiami Station
Miami, Florida 33144

Mr. Fred Dayhoff
SR 68
Ochopee, Florida 33943

Mr. Michael Duever
Nature Conservancy
Disney Wilderness Preserve
6075 Scrub Jay Trail
Kissimmee, Florida 34759

Mr. Mike Finch, District Drainage Engineer
Florida Department of Transportation
801 N. Broadway
P.O. Box 1249
Bartow, Florida 33831-1290

Mr. John Fitch
The Conservancy
1450 Merrihue Drive
Naples, Florida 33942

Mr. Mark Flora
Water Resources Division
NPS - Air
P.O. Box 25287
Denver, CO 80225

Mr. Allen Hall, Director
South Florida Water Management District
P.O. Box 24680
3301 Gun Club Road
West Palm Beach, Florida 33406-4680

Mr. Mike Hart, Acting Preserve Manager
Fakahatchee Strand State Preserve
P.O. Box 548
Copeland, Florida 33926

Mr. Aaron Higer
Senior Scientist
U.S. Geological Survey
Water Resources Division
3301 Gun Club Road
West Palm Beach, Florida 33416-4680

Ms. Alice Johns
National Park Service
Water Resources Division
1201 Oak Ridge Drive, Suite 250
Ft. Collins, CO 80525

Mr. Robert Johnson
National Park Service
Everglades National Park
4001 State Route 9336
Homestead, Florida 33034-6733

Mr. Jim Krakowski
Florida Panther National Wildlife Refuge
U.S. Fish and Wildlife Service
3860 Tollgate Blvd., Suite 30
Naples, Florida 33942

Ms. Bonnie Kranzer
Executive Director
Governor's Commission for Sustainable South Florida
1550 Madruga Avenue, Suite 220
Coral Gables, Florida 33146

Mr. Glenn Landers, P.E.
U.S. Army Corps of Engineers
Jacksonville District
400 West Bay Street
P.O. Box 4970
Jacksonville, Florida 32232-0019

Ms. Nancy Little
South Florida Water Management District
7257 Westport Place
Building A-100
West Palm Beach, Florida 33413

Mr. Bill Lorenz, Director
Collier County Department of Natural Resources
3301 Tamiami Trail East
Health and Community Services Building #H
c/o Natural Resources
Naples, Florida 33962

Mr. Gary Lytton
Rookery Bay
National Estuarine Research Reserve
10 Shell Island Road
Naples, Florida 33962

Mr. Ben McPherson
U.S. Geological Survey
Water Resources Division
4710 Eisenhower Blvd, Suite B-5
Tampa, Florida 33614

Ms. Pam McVerty
Executive Coordinator for Ecosystem Management
Department of Environmental Protection
3900 Commonwealth Blvd.
Tallahassee, Florida 32399

Samuel Poole, III
South Florida Water Management District
P.O. Box 24680
3301 Gun Club Road
West Palm Beach, Florida 33416-4680

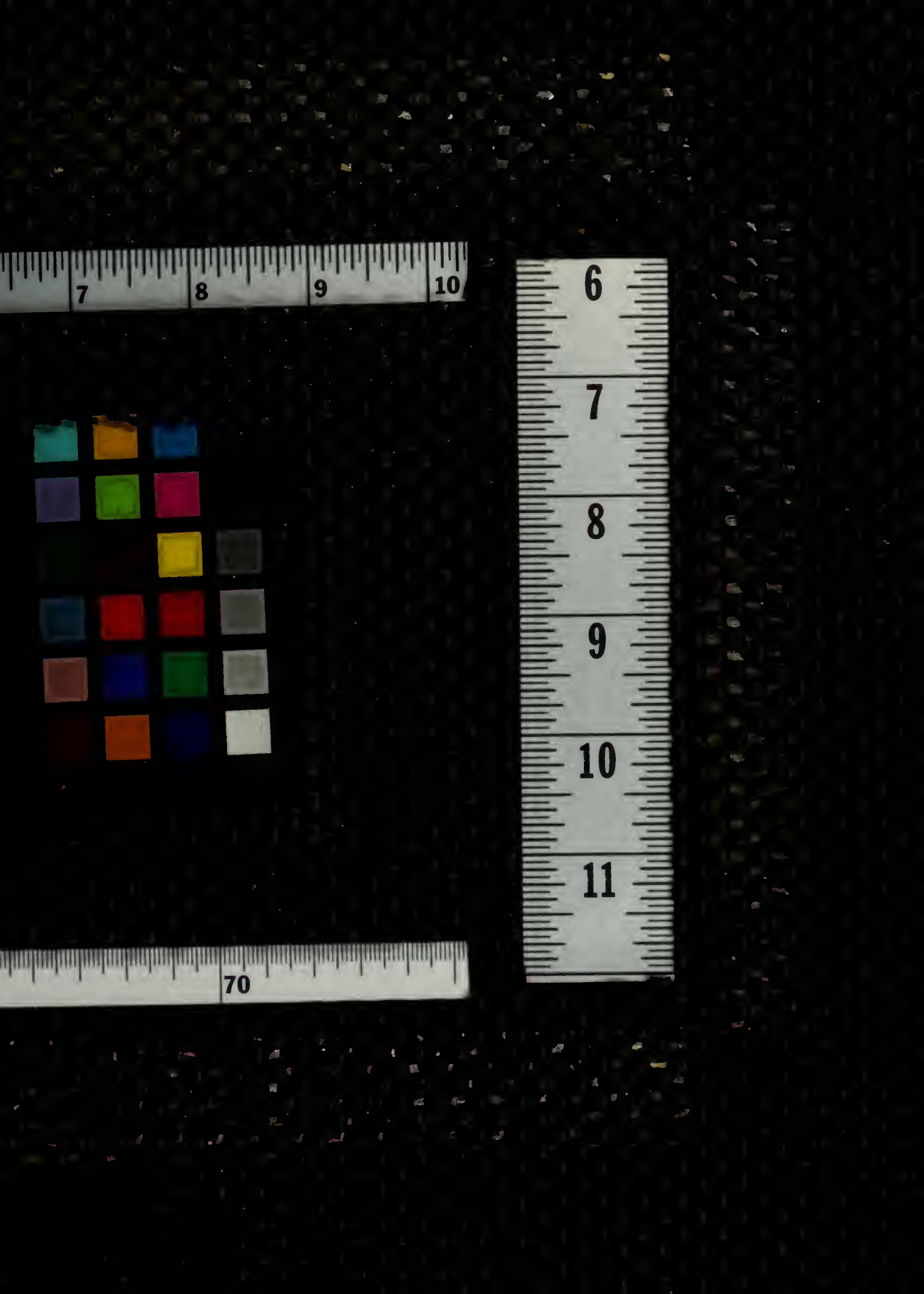
Col. Terrence "Rock" Salt
Executive Director
Federal Task Force Office of the Executive Direc
Florida International University
OE Building, Room 148
Miami, Florida 33199

Mr. Daniel Scheidt
Environmental Protection Agency, Region VI
Environmental Services Division
960 College Station Road
Athens, Georgia 30613-0801

Mr. David Sikkema
National Park Service
Everglades National Park
40001 State Route 9336
Homestead, Florida 33034-6733

Mr. Paul Van Buskirk, Director
South Florida Water Management District
Big Cypress Basin Board
6167 Janes Lane
Naples, Florida 33942

Mr. George Yilmaz, Director
Collier County Pollution Control Department
3301 Tamiami Trail E.
Health and Community Services Bld., # H
c/o Pollution Control
Naples, Florida 33962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